Final Report

MTC REGIONAL TRANSIT CAPITAL INVENTORY PROJECT

Survey of Regional Transit Capital Asset Management Systems

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and

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1.0 PROJECT OVERVIEW

1.1 Background

The Metropolitan Transportation Commission (MTC) is responsible for developing and updating the Regional Transportation Plan (RTP) for the development of mass transit, highway, airport, seaport, railroad, bicycle and pedestrian systems and facilities throughout the nine-county San Francisco Bay Area. The region enjoys one of the most diverse transit environments in the nation in terms of modes and land uses. This is an environment where transit use is considerably higher than in peer Western metropolitan regions. Capital replacement and rehabilitation of transit assets is an important and growing need.

Bay Area Operators

Approximately one third of the nation's fifty largest metropolitan areas do not have a single regional transit authority. The greater Bay Area, with 21 transit agencies in operation, falls into this minority. This area also has three of the fifty largest cities in the U.S., nine counties with a population of 6.9 million people, and 101 cities. The systems are extremely diverse, as illustrated in Exhibit 1-1 below.

Exhibit 1-1: Bay Area Operators

Transit Agency	Symbol	Initial Service	Age	Key Modes	Fleet Range
Caltrain	Caltrain	1863 (JPB 1992)	144	Commuter rail	100-400
Municipal Railway	MTA/MUNI	1912	95	LRV, bus, trolleycoach, cable car	Over 400
City of Vallejo	Vallejo Transit	1956	51	Ferry, bus, paratransit	0-100
Santa Rosa CityBus	Santa Rosa CityBus	1958	49	Bus, paratransit	0-100
Alameda-Contra Costa Transit	AC Transit	1960	47	Bus, paratransit	Over 400
Golden Gate Bridge, Highway and Transportation District	GGBHTD	1970	37	Bridge, ferry, bus, paratransit	100-400
Santa Clara Valley Transportation Authority	VTA	1972	35	Bus, LRV, paratransit	Over 400
Napa County Transportation Planning Agency	NCTPA	1972	35	Bus, paratransit	0-100
Bay Area Rapid Transit District	BART	1972	35	Heavy rail	Over 400
Union City Transit	UCT	1974	33	Bus, paratransit	0-100
San Mateo County Transit District	SamTrans	1976	31	Bus, paratransit	100-400
Eastern Contra Costa Transit Authority	Tri Delta Transit	1976	31	Bus, paratransit	0-100
Western Contra Costa Transit Authority	WestCAT	1977	30	Bus, paratransit	0-100
Fairfield-Suisun Transit	FST	1978	29	Bus, paratransit	0-100
Central Contra Costa Transit Authority	CCCTA	1980	27	Bus, paratransit	100-400
Sonoma County Transit	SCT	1980	27	Bus, paratransit	0-100
City of Vacaville Transit	Vacaville City Coach	1981	26	Bus, paratransit	0-100
Livermore Amador Valley Transit Authority	LAVTA	1985	22	Bus, paratransit	0-100
Benicia Breeze	Benicia Breeze	1986	21	Bus, paratransit	0-100
City of Alameda Ferry Program	City of Alameda Ferry Program	1989	18	Ferry	0-100
San Joaquin Rail Commission	ACE	1998	9	Commuter rail	0-100

While a number of these systems are linked via operating agreements, Memoranda of Understanding, shared facilities, and other initiatives such as TransLink®, the 21 agencies are considered separate, stand-alone organizations with their own policy boards, administrations, and funding. MTC, working in conjunction with the greater Bay Area operators, has determined regional guidelines for capital replacement. Each agency pursues its own replacement needs under these guidelines.

Transit system capital assets span the gamut from revenue vehicles and systems to stations, other facility types (e.g., park and ride lots, maintenance facilities), and specialized equipment (e.g., communications equipment). An illustration of transit assets is shown in Exhibit 1-2 below.

Exhibit 1-2: Transit Asset Base

MTC Transit Capital Priorities Process

In its Transportation 2030 document (i.e., the Regional Transportation Plan - RTP), published in February 2005, MTC estimated the capital replacement needs of the Bay Area's transit operating agencies at approximately $16.2 billion over 25 years, with $12.1 billion in revenues likely to be available. This left an unfunded shortfall of approximately $4.1 billion for the period 2005-2029. As a result of Transportation 2030, MTC reserved an additional $1.3 billion of Federal flexible funding for transit capital shortfall needs, leaving a remaining shortfall of $2.8 billion.

Due to the limited funds available, the MTC Commission has chosen to limit the projects eligible for the transit capital shortfall funds to the highest scoring projects in MTC's Transit Capital Priorities (TCP) process. The highest scoring projects are generally revenue vehicle replacement projects, and projects for the replacement and rehabilitation of the track and power delivery systems on the rail operations in the region. Lower scoring projects, such as equipment purchases or facility rehabilitations, are therefore generally funded through local sources, such as sales taxes, or operating funds.

Over the 25 year period covered by Transportation 2030, MTC expects to program approximately $7.3 billion in Federal formula funds (Section 5307 and Section 5309). The majority of these funds is expected to be programmed to the

highest scoring projects in the TCP process, or the projects known as "Score 16" projects. MTC's process ranks projects from highest (Score 16) to lowest (Score 8). Project types and their scores are shown in the table below:

Exhibit 1-3: MTC Transit Capital Priorities Scoring Levels

Project Category	Project Score
Revenue Vehicle Replacement / Rehabilitation *	16
Fixed Guideway Replacement / Rehabilitation *	16
Ferry Replacement / Rehabilitation *	16
Ferry Propulsion Systems	16
Ferry Major Components	16
Ferry Fixed Guideway Connectors	16
TransLink	16
Safety	15
ADA / Non Vehicle Access Improvement	14
Fixed / Heavy Equipment, Maintenance / Operating Facilities	13
Intermodal Stations	12
Station / Parking Rehabilitation	12
Service Vehicles	11
Tools and Equipment	10
Office Equipment	9
Capitalized Maintenance, including tires / tubes / engines / transmissions	9
Operational Improvements / Enhancements	8
Expansion	8
* For urgent replacements not the result of deferred maintenance and replacement of assets 20% older than the usual replacement cycle (e.g. 12 or 16 years for buses dependening on type of bus), project may receive an additional point to 17 points.	

Source: MTC

The remainder of the funds for transit rehabilitation and replacement projects or for transit expansion projects come from local sales tax funds over the next 25 years. Approximately $4.8 billion is expected to come from local sales tax funds, other local funds, Federal Flex funds (such as STP or CMAQ), State Transportation Improvement Program (STIP) funds, and Bridge Tolls.

As the Metropolitan Planning Organization (MPO) and the designated recipient for the Federal formula funds for the nine-county region, MTC coordinates the programming of state and federal funding sources. MTC must determine each project's compatibility with the regional long range plan and conformity with the Transportation Improvement Program (TIP). MTC's process involves coordination with all transit operating agencies, each county's Congestion

Management Agency (CMA), Caltrans and the Federal Transit Administration (FTA). Key FTA funding programs to transit agencies are summarized in Exhibit 1-4 on the following page.

Exhibit 1-4: Federal Transit Administration Funding Summary

The FTA provides both capital and operating assistance to Bay Area operators. MTC and MTC agencies currently obtain funding assistance through the following FTA grants programs:

- Section 5303 Metropolitan Planning Program: FTA distributes these funds are based on urbanized area population and an FTA administrative formula. The funds are used to address planning needs in urbanized areas. Currently, twenty Bay Area operators request FTA Section 5303 funds for assistance in preparing their Short Range Transit Plans (SRTP).

- Section 5307 Urbanized Area: These funds are distributed to regions based on an urbanized area formula. Twenty operators Bay Area currently request FTA Section 5307 funds. In 2004, this source provided roughly in $210 million in funds to Bay Area operators.

- Section 5309 Fixed Guideway and Ferry: FTA distributes these funds to regions on based on the characteristics of the existing rail and ferry investments (e.g., track miles). MTC staff works with the region's transit operators to determine how these funds are programmed. There are currently seven operators in the Bay Area that request FTA Section 5309 FG funds. In 2004, this source provided roughly in $63 million in funds to Bay Area operators.

- Section 5309 Bus and New Starts Funds: These are discretionary funds at the Congressional level. FTA Section 5309 Bus can be used for capital projects such as replacement or expansion of buses or bus facilities. FTA Section 5309 New Starts are used for building new rail, bus rapid transit, and ferry systems, or extensions to existing systems. In 2004, this source provided Bay Area operators with roughly in $10 million in bus funds and $110 million in New Starts funds.

- Section 5310: These funds are distributed to the states by the federal government to provide transit capital grants to non-profit agencies that provide transportation services to the elderly or persons with disabilities.

- Section 5311: These funds are distributed to the regions on non-urbanized area formula. These funds are used for transit capital and operating purposes in non-urbanized areas.

- Section 5316 Job Access and Reverse Commute (JARC): These funds are directed to services that provide transportation to low income individuals. In 2004, this source provided roughly in $2 million in funds to the Bay Area.

- Surface Transportation Program (STP): Transit Capital Shortfall Funds are Federal Highway Administration funds that the MTC region "flexes" to transit capital projects. MTC sets aside these funds to meet high-scoring transit capital shortfall needs. Since 1992, flexible funding sources have provided the Bay Area with roughly $50 million annually in funds.

When compiling the RTP, MTC receives submittals from each transit operating agency about the major assets that each agency owns, and from this data, MTC develops estimates of capital replacement needs over the 25-year life of the RTP. The transit operating agencies in the MTC region put forward their Capital Improvement Plans as well as specific capital project data in support of their funding needs.

As the steward of this funding process, MTC faces several challenges when allocating funds between the region's transit operators:

- Limited Funds and Increasing Needs: Growth of available funding has been flat in recent years, while the demand for capital funds continues to increase[1]. This leaves some projects unfunded or delayed, and therefore places acute importance on ensuring available funds are allocated in the most efficient manner.

- Inconsistent Justification Process Across Agencies: Processes and procedures for justifying new project funding requests are inconsistent across operators. This may lead to a sub-optimal, and potentially inequitable, allocation of funds.

- Absence of Regional Asset Inventory: A consistent regional needs analysis process is required to forecast long-term needs. The lack of a current region-wide asset inventory prevents a clear evaluation of needs over the long term, across all MTC agencies. A failure to meet those needs will likely impact long-term service quality, reliability, and safety.

In response to these challenges, MTC has initiated the Regional Transit Capital Inventory (RTCI) Project to develop a robust, repeatable process to boost regional agency projects' compatibility with the regional long range plan and then support regional funding for project implementation. MTC is focused on maintaining comprehensive, current and reliable capital asset inventory data across the region. The first – and obvious – benefit would be an improved allocation of capital funds. Secondly, an improved ability to demonstrate both regional transit funding needs and benefits of investments may also quite possibly result in increased funding for the entire region.

As envisioned, the project will be carried out over multiple years, and in three phases:

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1 ***BART alone has identified over $4.1 billion in capital funding shortfall over 30 years (30 Year Capital Plan Board Presentation, January 26, 2006).***

Exhibit 1-5: RTCI Phases

PHASE 1	Assess Transit Property Capital Inventory Methodology and Establish Base Level of Transit Capital Data Detail
PHASE 2	Improve Capital Inventories as Needed
PHASE 3	Develop RTCI Database and Automate Transmission of Data

This working paper summarizes the initial results from Phase 1 of the work.

1.2 Study Objectives

MTC has initiated this Regional Transit Capital Inventory Project (RTCI) in order to improve MTC's ability to forecast regional transit capital rehabilitation and replacement funding needs across all of the region's providers of transit services, and to more effectively program available funding.

Ultimately, the best way to achieve these objectives is to collect consistent and standardized project information on a regular basis, based on consistent and standardized definitions, through a transparent, and to the extent possible, automated data collection process. Regional standards for asset inventory data are necessary to ensure meaningful and reliable comparisons between operators and to facilitate aggregation of local needs into regional totals.

Desired objectives of Phase 1:

- Documentation of, as well as a better understanding of, the key transit agency systems, procedures, and asset inventory data with respect to capital replacement and rehabilitation
- Assessment of the feasibility of and requirements for a regional transit capital inventory.

Accordingly, activities for Phase 1 of this study include:

- Identifying the data sources transit inventory data, including inventories, General Ledger, grants management records, or National Transit Database reports

- Evaluating the sources, and documenting how transit capital data (e.g., rehabilitated assets) are collected, stored and used by the operators, including how capital asset information is communicated between the divisions within each operator agency

- Evaluating the asset inventory database(s) in place at each operator, as well as linkages (or lack thereof) to lists and programs containing meaningful capital asset replacement information, such as condition of the assets

- Assessing the current capital asset inventory data maintained by the regional transit operators

- Identifying a common base level of data maintained by the operators, and determining the feasibility and requirements for the establishment of a regional transit capital inventory system.

The MTC project team determined that a detailed survey of the 21 Bay Area transit operators was the best tool to collect most of the relevant information.

2.0 WORK APPROACH

For the purposes of conducting the survey, MTC divided the transit agencies into two tiers:

- Tier 1 agencies – Generally the larger, multiple-mode agencies or whose service area lies within the San Francisco / Oakland / San Jose Urbanized Zone Areas (UZAs), or whose service area overlaps with operators in these UZAs
- Tier 2 agencies – Generally the smaller, bus-only systems, whose service areas are in discrete stand-alone UZAs, or agencies that do not normally participate in MTC's Transit Capital Priorities process.

Exhibit 2-1: RTCI Project Tier 1 and Tier 2 Agencies

Tier 1	Tier 2
Alameda-Contra Costa Transit District (AC Transit)	Alameda-Oakland Ferry
San Joaquin Rail Commission (ACE)	Benicia Transit
San Francisco Bay Area Rapid Transit (BART)	Napa Valley Transit
Caltrain	Santa Rosa City Bus
Central Contra Costa Transit Authority (CCCTA)	Sonoma County Transit
Golden Gate Bridge, Highway and Transportation District (GGBHTD)	Union City Transit
Livermore Amador Valley Transit Authority (LAVTA)	Fairfield-Suisun Transit
San Francisco Municipal Railway (MUNI)	Vacaville City Coach
Santa Clara Valley Transportation Authority (VTA)	
San Mateo County Transit District (SamTrans)	
Eastern Contra Costa Transit Authority (Tri Delta Transit)	
Vallejo Transit	
Western Contra Costa Transit Authority (WestCAT)	

A handful of Tier 1 systems, whose service areas overlap with operators in the San Francisco / Oakland / San Jose UZAs, are smaller than some of the Tier 2 systems.

2.1 Base MTC Interview Questions

In the development of its Request for Proposals, MTC established a set of questions that were to form the backbone of the RTCI Phase I effort. The questions were divided into two groups. The first group (shown in Exhibit 2-2) addressed capital asset data and data management systems.

Exhibit 2-2: Assessment of Transit Operator Capital Asset Data and Data Management Systems Questions

A. What data management system(s), if any, do the operators use to track and manage their capital assets and repair, rehabilitation and replacement needs?

B. What types of data on capital assets does each operator maintain, including but not limited to types of assets, data fields for each asset type, and level of detail?

C. How and how often do operators update their capital asset data?

D. How current, complete, and accurate is each operators capital asset data?

E. How does each operator store and utilize capital asset data, and how is the capital asset information communicated between the operators internal divisions?

F. How does each operator use its capital asset data to manage its rehabilitation and replacement needs, and to estimate costs for such projects? Is this information used for funding requests, or are other systems used? How closely does asset management staff coordinate with funding / grants staff?

G. Other issues pertaining to each operator's transit capital data and data management systems that are relevant to the RTCI project as identified by the Consultant.

MTC established that given their size, only a subset of Questions A-G needed to be asked of Tier 2 operators, namely Questions A and B.

The second group of questions (shown in Exhibit 2-3) explored the feasibility of developing a regional transit capital inventory, as well as associated requirements.

Exhibit 2-3: Assessment of Feasibility and Requirements for Regional Transit Capital Inventory Questions

A. Given the existing asset management databases of the region's transit operators, what data standards and formatting should the region establish for the RTCI in order to improve MTC's ability to forecast the need for transit capital rehabilitation and replacement funding in the region, and to program available funding to meet the highest priority needs?

B. Which of the assessed operators can provide data for the RTCI that meets the recommended standard and which cannot supply the information without improvements to their data, data management systems and / or internal processes relating to their transit capital inventory? What are the significant differences and gaps in the data maintained by the operators?

C. What will be required in terms of additional data gathering, software and / or staff resources for each operator to provide data that meets the regional standard for the RTCI?

D. What will be the estimated initial and ongoing costs for MTC and each operator to provide data required to develop and maintain the RTCI ?

E. How can each operator improve its use of capital asset data to manage rehabilitation and

replacement needs, to estimate costs for such projects, and to meet MTC reporting requirements?

F. Other issues pertaining to each operator's transit capital data and data management systems that are relevant to the RTCI project as identified by the Consultant.

2.2 Consultant Approach

The Booz Allen Hamilton / URS consultant team worked with MTC staff to develop a definitive interview guide to ensure a consistent approach to the collection of the information and the most complete responses possible from the transit operators. The interview guide included all the questions listed above in Exhibits 5 and 6, as well as a variety of follow-up questions related, for instance, to retirement of assets and linkages between agency asset management systems. The consultant team also developed a series of specific questions targeting rail-operators systems.

The final interview guide identifies base contact information and target interviewees at the transit agency, and presents the RTCI questions in two groups (Part I – Capital Asset Data and Part II – Capital Asset Management Systems). The interview guide is attached as Appendix B.

In administering the interview guide, the team was challenged by both by the breadth of agencies to interview, as well as by a short timeframe corresponding with the traditional holiday months of November and December.

First, the team worked with MTC to ensure the transit agencies received early notification and communication about project needs and criticality to cooperate with the consultant team in a timely fashion. MTC convened the Partnership Transit Finance Working Group (TFWG) and the project's Working Group on October 18, 2006. The consultant team presented the project approach, discussed expectations, and distributed advance copies of the interview guide. About a week later, the final interview guide was distributed electronically to the attendees.

The consultant team worked through the network of agency contacts already present in the RTCI Working Group. The consultant team then contacted each agency by telephone to set the interview dates, then followed up with a face-to-face meeting with the relevant parties at the agency to populate the interview guide. Building on the survey results, the consultant team also set to work on developing individual "operator reports", a separate deliverable for MTC. In

some cases, the consultant team forwarded preliminary drafts of the individual operator report to the agency to review for accuracy and for general comment.

2.3 Interview Results

For each operator, the answers to questions A-G (Tier 1) and questions A-B (Tier 2) on transit operator capital asset data and data management system, are provided in Appendix A. The remainder of this report examines the significance of the findings across agency types, specifically related to:

- Data Sources (Chapter 3)
- Asset Coverage (Chapter 4)
- Data Quality (Chapter 5)
- Capital Planning Process (Chapter 6).

Chapter 7 contains preliminary conclusions and recommendations based on the findings to date.

3.0 RESULTS – LOCAL AGENCY DATA SOURCES

A key objective of the agency interview process was to identify the full range of capital asset data sources used and maintained by each of the local Bay Area transit operators. Specifically, this included identification of any agency data source that might be used either on its own, or in combination with other sources, to potentially support development of a regional asset inventory.

In completing this survey, the project team identified a broad range of data sources and data source types that contain data relevant to the development of a regional transit capital asset inventory. These sources ranged from "true" capital asset inventories to sources that contain partial or related capital asset inventory information. For the purposes of this study, the term "capital asset inventory" is defined as a collection of asset records that can be used, with little or no modification, as direct input to a long-term capital needs assessment process. Hence, this definition excludes sources of asset records that either do not provide all the required data fields required for a capital needs assessment, that contain capitalized assets that will not require future rehabilitation or replacement (e.g., land, investment studies, fund transfers), or that possess some other limitation making the source inappropriate for direct entry into a capital planning process.

From the perspective of identifying existing data sources that are currently "operationally ready" to support a long-term capital needs assessment process (i.e., without material modifications), the project team identified few data sources that can properly be defined as true "asset inventories" as defined above. Rather, the majority of the sources identified may be used to support capital asset inventory development (e.g., if modified and/or combined with other sources) but do not represent "true" capital asset inventories themselves. Moreover, most identified sources do not contain all of the data elements (i.e., fields) desired for long-term needs analysis or are not directly linked to any related agency data sources that do contain the missing data.

Hence, based on the current survey it is clear that development of a regional capital asset inventory will require some effort to establish regional reporting standards that all agencies can meet fairly.

3.1 Data Sources Identified

In analyzing the interview results, the project team identified the following general types of data sources containing capital asset inventory related data as currently utilized by Bay Area operators:

- Capital planning asset inventories

- Fixed asset databases
- Grants management databases
- Maintenance management systems
- Asset condition assessments
- Fleet rosters and fleet replacement plans
- Special division / department Sources.

Below are descriptions of the general characteristics of these different types of sources and of the use of these sources by regional operators.

Asset Inventories

Though rare in the past, an increasing number of U.S. transit agencies are developing and maintaining asset inventories that are comprehensive of their entire asset holdings and which are also suitable for capital needs analysis. These inventories typically include a hierarchy of asset types, data on asset type, cost, unit quantities, acquisition date, network location, and asset condition (either as assessed by engineers or inferred based on asset age and assumed remaining life). A high quality asset inventory may also maintain data on asset rehabilitation activities (where these activities are tied to specific asset records). For the purposes of this study, a data source must provide most or all of these data elements be "operationally ready" to support capital needs assessment activities (with little or no modification) to meet the definition of "asset inventory".

At present, none of the 21 regional operators currently maintains a data source that closely complies with the definition of asset inventory as outlined above and which is relatively comprehensive of all agency assets. One MTC operator, Caltrain, maintains comes close with its state of good repair database: through it does not address vehicles, the recently developed in-house system can be used as direct input to a long term capital needs assessment process for much of Caltrain's infrastructure. However, it should be noted that most of the 21 regional operators do maintain fleet vehicle records suitable for long-term capital needs analysis (as required to support their annual National Transit Database – NTD- submissions). Moreover, there are a few cases where individual agencies maintain good quality data for other asset types (e.g., BART trackwork data).

For the regional operators that do have asset inventories, these operators typically use this data for the purpose of asset repair needs analysis, condition analysis, short- to long-term capital reinvestment analysis.

Fixed Asset Databases

While providing much of the same information, fixed asset databases are generally designed to support financial accounting activities (e.g., depreciation

analysis) and hence have some important differences with true asset inventories (see below). Specifically, fixed asset databases are designed to record the purchase (cost and purchase date), accounting depreciation and disposal of all agency capital purchases. A key role of these databases is to support annual and quarterly financial reporting and related accounting activities. Given their accounting orientation, fixed asset databases have some important similarities and several equally important differences with a true asset inventory:

Key Similarities with True Asset Inventories:

- Records the asset type, purchase cost and purchase date of all agency assets (usually over a minimum reported value, such as $5,000)
- Records useful life (although this may be an accounting useful life used for deprecation and not an expected service life)
- May record asset disposal
- May record the asset's location and the mode it is associated with (for multi-modal operators).

Key Differences with True Asset Inventories:

- Contains records for capitalized assets that do not require rehabilitation or replacement -- examples include land (for buildings and Right of Way - ROW) and the capitalized value of special studies or other services
- While identifying purchase cost, fixed asset databases rarely identify the quantity of assets purchased (e.g., an entry may denote the purchase of "shelters" but not the number of shelters purchased)
- Records may not be categorized into a useful hierarchy of asset types (i.e., data may not be readily segmented into categories such as structures, trackwork, vehicles, stations, systems, etc.) and may not be assigned to a specific agency mode
- Rehabilitation activities are recorded as separate data entries that are not tied to the rehabilitated asset
- Do not have data on assessed asset physical condition or useful life remaining
- Not always linked to maintenance management systems
- Do not typically identify asset location making it difficult to physically locate a specific asset.

In the absence of a "true" asset inventory, fixed asset databases represent the next best alternative source of asset inventory data. However, given their characteristics as defined above, data derived from fixed asset databases require considerable manipulation when used as the source data for an asset inventory.

Even with this manipulation, the resulting data source will (1) still lack some important data items (e.g., the ability to tie rehabilitation activities to specific assets; and (2) require ongoing conversion of new data as new asset records are entered into and (removed from) the source fixed asset database.

All of the 21 regional operators reported having a fixed asset database, each of which was relatively comprehensive of all agency assets. As noted above, the primary purpose of these fixed asset databases is to support accounting and financial reporting needs. Even though fixed asset databases data are typically updated once per year or once every two years as part of the physical inventory, these data sources are rarely used for capital needs analyses.

Grants Management Systems

Grants management systems provide a record of all transit assets purchased using local, state or federal grants funds. Similar in some ways to fixed asset databases, these systems can hide significant levels of detail by grouping assets purchased under a single grant or contract. Also, these systems typically do not record disposal of an asset upon retirement and also will not tie the cost of rehabilitation activities associated to specific assets. As with fixed asset databases, grants management systems include records for capitalized land, consultant studies and other "assets" that do not require replacement. More importantly, grants management databases will not record the purchase of assets that are not tied to specific grants funds. Moreover, those purchases that are recorded frequently group a broad array of assets within a single grants management record (i.e., recording assets with very different life cycle rehabilitation / replacement requirements within a single grants record).

Overall, grants management systems represent less reliable sources of capital asset data as compared to either true asset inventories or to fixed asset databases. With respect to the development of a regional asset inventory, this source should be viewed only as a source of last resort.

All of the local operators will maintain some record of their capital grants and the related expenditures. However, there are significant differences in the types and sophistication of the systems used to record this data – with some of the smaller operators recording this information on simple, spreadsheet listings while the larger, primarily rail operators, record their grants information in specialized databases, sometimes in multiple locations within one operator. For instance, Muni records grant information in two areas. Capital Planning maintains an Access database for capital planning purposes that is grant and cost-based, not asset-based, and it is used by the capital planners and the grants group. It is not used, however, by Grants Accounting or the project managers for project implementation. Accounting maintains a separate grants listing in the

accounting system, FAMIS, which is used to prepare project budgets for purposes of project management and grants management and accounting. Manual coordination is required between these two systems.

Maintenance Management Systems

Most transit operators use some type of maintenance management systems to document maintenance and rehabilitation activities performed on their transit assets. While potentially a valuable source of data for asset inventory holdings, maintenance management systems are usually only utilized for a sub-set of an operator's transit assets (typically just fleet vehicles but sometimes facilities and Rights of Way components as well) and hence are not comprehensive of all assets. On the positive side, these systems record both asset inventory and asset rehabilitation data in a relational database (such that rehabilitation activities are tied to specific assets). Given these characteristics, maintenance management systems represent valuable sources of data for those asset types documented in those systems but are only useful in documenting a portion of an operator's total capital assets.

Most of the 21 regional operators currently utilize some form of maintenance management system. Note, however, that for many smaller operators, the maintenance management systems identified are spreadsheet-based listings of maintenance activities and hence do not necessarily have the ability to correlate rehabilitation activities to specific assets. For those agencies that do use commercially based maintenance management systems, these systems are generally only being used for fleet maintenance and hence do not provide information on other asset types.

Asset Condition Assessments

Several of the agencies interviewed reported conducting periodic condition assessments of portions of or all of their capital assets. The results of these inspections were then documented in an asset condition database. Asset condition data are obviously of key interest when developing a capital asset inventory for the purposes of long-term capital needs assessments. However, it should be noted that (1) none of the agency condition sources identified were linked to other databases (such as an asset inventory or fixed asset database) and (2) the criteria used to assess asset physical conditions is not standardized across the region's operators. Hence condition assessment data are not comparable and of minimal utility for regional capital planning purposes.

Fleet Rosters and Fleet Replacement Plans

Most of the agencies interviewed maintain an active fleet replacement plan. In addition, all of the Tier 1 and most of the Tier 2 operators are required to report their current active revenue vehicle fleets to the NTD. With the potential

exception of providing adequate information on the rehabilitation activities of individual vehicles, one or more of these sources provide good quality information suitable for populating a regional asset inventory. The replacement plans are also useful in establishing each agency's expectations for vehicle useful life

Special Division / Department Sources

Transit agencies are generally structured such that different groups of transit assets are the responsibility of different departments (e.g., fleet management and maintenance of right of way are typically in different departments). It is frequently the case, that one or more persons within each department is currently maintaining some form of asset inventory data source covering some or all of the assets under that department's control. While these sources only provide data on a limited segment of an agency's total asset holdings, their quality can be quite good and hence they represent potential alternative sources for asset inventory development. However, given their nature (e.g., specific records created to support the specific needs of a sub-segment of an agency's organization), these sources are far from standardized and rarely contain all of the types of information required to support regional asset inventory development (e.g., they may document an asset's existence, but not its age and/or expected remaining useful life).

In addition, many of the agencies interviewed identified having sources documenting agency policies regarding the scheduling of maintenance, overhaul, and replacement activities for fleet vehicles and some other asset types. While not necessarily useful in identifying the age or condition of specific agency assets, these sources will be of considerable use to MTC when developing future needs analyses using any regional asset inventory database. They are also of use in determining what rehabilitation activities have most likely been completed given an asset's age.

3.2 Summary of Existing Sources

The table below (Exhibit 3-1) summarizes the types of data sources used by regional operators that document operator asset inventory holdings. Specifically, the table identifies each source, its primary purpose (i.e., the activities it supports), the source's frequency of use among regional operators and the limitations of each source as a source of capital asset inventory information.

Exhibit 3-1: Summary of Existing Sources of Capital Asset Data

Source Type	Purpose	Frequency of Use by Regional Operators	Limitations as Source of Capital Asset Inventory Data
Asset Inventory (i.e., Capital Planning Ready)	Capital planning	None that include all asset types	- Few limitations / optimal data source for regional asset inventory development - May not document rehabilitations
Fixed Asset Database	Financial accounting (not used for capital needs analysis)	High	- Insufficient detail or too much detail - Assets poorly categorized - Rehabilitation records not linked to specific assets - Includes assets not requiring replacement (e.g., land, studies)
Grants Management Systems	Management of capital grants (not used for capital needs analysis)	High	- Same limitations as fixed asset databases - Does not record asset retirement - Assets with widely differing life-cycle characteristics grouped together
Maintenance Management Systems	Asset repair and rehabilitation activities	Moderate (relatively few use a commercial product)	- Only document a fraction of asset holdings (e.g., just vehicles) - Many smaller operators using Excel spreadsheets - May not document asset date built or purchase cost
Asset Condition Assessments	Re-investment prioritization	Moderate	- Do not cover all asset types - Not linked to other data sources (e.g., fixed asset db) - No standardized condition rating criteria
Fleet Rosters and Fleet Replacement Plans	Fleet replacement needs analysis	High	- Only documents revenue vehicle fleet
Special Division / Department Sources	- Document segment of agency asset holdings; support immediate needs of agency department or division staff	Moderate	- Do not cover all asset types - Not standardized documents - Rarely contain all data required for asset inventory development

Exhibit 3-2 below presents much of the same information as Exhibit 3-1, this time arrayed by regional operator. Both of these exhibits and the analysis presented

above emphasize the following key points of interest with respect to the development of a regional asset inventory:

1. Capital Planning Asset Inventories: Few operators currently possess a "true" asset inventory source that is operationally ready for use in capital planning – hence this source type (at least as they exist today) does not represent a viable option for development of a regional asset inventory.

2. All Operators Have Detailed Fixed Asset Databases: The interviews confirmed that nearly all regional operators have a fixed asset database system. These sources represents the most comprehensive ***single existing*** source of asset inventory information available. These sources provide some but not all of the data fields required for capital planning analysis. Hence, this source type represents a viable but in many ways flawed source of regional capital asset inventory data (i.e., poor categorization, insufficient detail, insufficient condition information).

3. There is a Wide Variety of "Partial" Data Sources: These partial sources, including maintenance management systems, asset condition reports, fleet management plans and special department / division sources, can provide good capital asset data for specific segments of an operator's asset holdings (most notably revenue fleet vehicles but occasionally other asset types as well). Hence, these collective sources represent valuable, alternative sources of data that can be used to ***assist*** regional inventory development but lack sufficient coverage to fully construct a regional inventory.

4. Some Sources Provide Additional Data on Life-Cycle Needs: Some of the sources identified by staff interviews provide valuable information on asset life-cycle costs and the timing of rehabilitation and replacement activities. Hence, while not necessarily providing information on current asset holdings, these sources can be of significant interest to the analysis of future Bay Area transit re-investment needs. Examples include the rehabilitation records from the maintenance management systems and useful life remaining assessments from the asset condition reports.

Exhibit 3-2: Summary of Data Sources by Operator

Operators	Capital Planning Ready Asset Inventory	Fixed Asset Database	Maintenance Management System	Asset Condition Reports / Database	Fleet Management Plan
Tier 1					
Alameda-Contra Costa Transit District (AC Transit)		Custom system	Ellipse		
Caltrain	State of Good Repair DB	PeopleSoft	ARROW	State of Good Repair DB	
Central Contra Costa Transit Authority (CCCTA)		DIBOL program	TMIS		
Eastern Contra Costa Transit Authority (Tri Delta Transit)		Depreciation Schedule	Maintenance System (Drive)		
Golden Gate Bridge, Highway and Transit District (GGBHTD)		IFAS	HOBBS HP-3000		Bus and Ferry
Livermore Amador Valley Transit Authority (LAVTA)		Excel Workbook			Vehicle Maintenance Plan
San Francisco Bay Area Rapid Transit District (BART)		Fixed Asset System	MARIS	Track, Structures & MP2	FMP
San Francisco Municipal Railway (Muni)		FAACS	SHOPS	none	Rail, Bus, Cable Car
San Joaquin Rail Commission (ACE)		Excel Workbook	HITS	UPRR ROW Condition Report	
San Mateo County Transit District (SamTrans)		PeopleSoft	SPEAR		
Santa Clara Valley Transportation Authority (VTA)		Asset Accounting Module	Plant Maint. Module	ROW Condition Report	Bus and LRV
City of Vallejo Transit		SunGard HTE Financial System	Contractor Database		Bus and Ferry
Western Contra Costa Transit Authority (WestCAT)		Excel Workbook	Extra Fleet		
Tier 2					
City of Alameda Ferry Program		City Database			
Benicia Breeze		Excel Workbook	Excel Workbook		Excel Workbook
Fairfield-Suisun Transit		Excel Workbook			Excel Workbook
Napa Valley Transit		Excel Workbook			Excel Workbook
Santa Rosa City Bus		DOS-based Database	DOS-based Database		DOS-based Database
Sonoma County Transit		Excel Workbook	RTA		Excel Workbook
Union City Transit	Fixed Asset Inventory List	Sage Database			Excel Workbook
Vacaville City Coach		Fixed Asset Listing	Fleet Maint App.		Excel Workbook

4.0 RESULTS – ASSET COVERAGE

The previous chapter described the full range of asset inventory related information sources identified for each of the 21 regional operators and provided some understanding of the strengths and weaknesses of those sources. This and the next chapter provide further analysis of the characteristics of these sources. Specifically, this chapter provides a summary of the range of asset types documented in each source. Key questions to be determined by this review include:

- Are all transit asset types – including vehicles, stations, structure, trackwork, control systems, facilities – documented in the data sources identified?
- Are some asset types better documented then others (i.e., their records include all desired data fields)?

This understanding is crucial from the viewpoint of determining the ability of the existing data sources to support development of a reliable regional asset inventory. Having further evaluated the contents of each data source, the next chapter then considers the ***quality*** of each source.

4.1 Transit Asset Types Reviewed

The evaluation of data source asset coverage as presented below utilizes a modified version of the transit asset types hierarchy utilized by several FTA data reporting and analysis systems (including FTA's Transit Economic Requirements Model, Standard Cost Category classification, and the Light and Heavy Rail Cost Studies). Each of these hierarchies group transit assets into the following five primary categories:

- Guideway and trackwork (including busways)
- Maintenance and administrative facilities (including equipment)
- Systems (train control, electrification, communications, fare collection)
- Stations, shelters and parking
- Vehicles (revenue and non-revenue).

Given their importance to the delivery of transit services, it is crucial that each of these category types be represented in any reliable inventory of capital assets. (While bus may be not as well represented as rail for some categories – e.g., "systems" – all bus operators have assets from each of these five categories.) At the same time, given the broad range of asset life-cycles within each of these five asset categories, reliable capital needs analysis requires a greater level of

reporting detail than just the five categories alone. For the purposes of assessing the asset coverage of the MTC agency sources of asset inventory information, this study used the listing of asset types presented in Exhibit 4-1 below. This listing is designed to capture all of the major assets and asset types utilized by the region's transit operators, focusing on those assets with either the greatest cost or the largest shares of expected long-term capital needs. Once again, the intention is to ensure that each of these asset types is represented in the existing data sources identified by the region's transit operators. Should the agency inventory sources not include one or more of these asset types, it is necessarily the case that needs analyses performed using an inventory derived from these sources would be incomplete.

Exhibit 4-1: Asset Listing Used for Review of Agency Data Sources

Asset Types	
Guideway Elements	Guideway
	Trackwork
	Special Structures
	Bus Guideway
Facilities	Buildings
	Parking / Lot Surface
	Storage Yard
	Equipment
	Waste Containment
	Central Control
Systems	Train Control
	Electrification
	Communications
	Security/Surv Equipment
	Central Revenue Collection
	Revenue Collection
	Utilities
Stations	Rail
	Motor Bus
Vehicles	Revenue Vehicles
	Non-Revenue Vehicles
	Equipment/Parts

In compiling the asset coverage matrices, the consultant team modified the outline above to fit each agency profile (e.g., deleting bus guideway, adding ferry assets, adjusting for rail assets as appropriate).

4.2 Summary of Findings

The results of the asset coverage analysis are presented below in Exhibits 4-2, 4-3 and 4-4. Specifically, Exhibit 4-2 presents the results for the Tier 1 rail operators,

Exhibit 4-3 presents the results for the Tier 1 non-rail operators, and Exhibit 4-4 presents the results for all Tier 2 operators. It is important to note that the evaluation of asset types coverage presented in these exhibits is based on agency staff descriptions of their own data sources.

A quick review of these exhibits yields the following two key insights:

> (1) Virtually all regional operators have fixed asset inventories that provide complete or near complete coverage of all asset types
>
> (2) Together, miscellaneous sources of asset inventory related information (including maintenance management systems, fleet management plans and similar data sources) only cover a fraction of each agency's asset holdings.

Based on these findings, it is clear that the only single, ***existing*** source (relatively) common to all agencies that is able to support development of a regional asset development is the agency fixed asset inventories. Hence, in the short-term, these databases likely represent the best alternative for relatively quick development of a regional asset inventory. However, as already noted fixed asset databases suffer from significant limitations and hence should only be considered as a short-term solution for regional inventory development. Longer term, development of an inventory either using an "80/20"-type approach (i.e., focusing on the 20 percent of assets that are responsible for 80 percent of the costs) or developing a new system from scratch will likely yield better long-term results.

Exhibit 4-2: Asset Coverage By Data Source for Tier 1 Rail Operators

Operator		Caltrain			BART		MUNI		ACE		VTA	
Asset Types		Asset Inventory	Fixed Asset Database	Misc. Sources*	Fixed Asset Database	Misc. Sources*	Fixed Asset Database	Misc. Sources*	Fixed Asset Database	Misc. Sources*	Fixed Asset Database	Misc. Sources*
Guideway Elements	Guideway Structures	■	■		■	■	■		■		■	■
	Trackwork	■	■	■	■	■	■		■		■	■
	Special Structures	■	■		■	■	■		■		■	■
	Bus Guideway		na		na		na		na		■	
Facilities	Buildings		■		■	■	■		■	limited	■	
	HVAC		■		■		■		■	coverage	■	■
	Parking / Lot Surface		■		■		■		■		■	■
	Storage Yard		■		■		■		■		■	■
	Equipment		■		■		■		■		■	■
	Waste Containment		■		■		■		■		■	■
	Central Control		■		■		■		■		■	
Systems	Train Control	■	■		■	■	■		■		■	■
	Electrification	■	■		■	■	■		■		■	■
	Communications	■	■		■	■	■		■		■	■
	Security/Surv Equipment	■	■		■		■		■		■	
	Central Revenue Collection	■	■		■		■		■		■	
	Revenue Collection	■	■		■		■		■		■	
	Utilities	■	■		■		■		■		■	
Stations	Rail	■	■		■		■		■		■	
	Bus Shelters		■		na		■		na		■	
Vehicles	Revenue Vehicles	■	■	■	■	■	■	■	■	■	■	■
	Non-Revenue Vehicles		■	■	■	■	■	■	■	■	■	
	Equipment/Parts		■	■	■	■	■	■	■	■	■	■

* Includes maintenance management systems
na - not applicable

■ Source provides substantial information for asset management
Sources does not provide substantial information for asset management

Exhibit 4-3: Asset Coverage By Data Source for Tier 1 Non-Rail Operators

Operator		AC Transit		CCCTA		Tri-Delta Transit		GGBHTD		LAVTA		SAMTRANS	
Asset Types		Fixed Asset Database	Misc. Sources*	Fixed Asset Database	Misc. Sources*	Fixed Asset Database	Misc. Sources*	Fixed Asset Database	Misc. Sources*	Fixed Asset Database	Misc. Sources*	Fixed Asset Database	Misc. Sources*
Guideway Elements	Guideway Structures	na		na		na		na		na		na	
	Trackwork	na		na		na		na		na		na	
	Special Structures	na		na		na		na		na		na	
	Bus Guideway	na		na		na		na		na			
Facilities	Buildings				limited				limited				
	HVAC				coverage				coverage				
	Parking / Lot Surface												
	Storage Yard												
	Equipment												
	Waste Containment												
	Central Control	na		na		na		na		na		na	
Systems	Train Control	na		na		na		na		na		na	
	Electrification	na		na		na		na		na		na	
	Communications												
	Security/Surv Equipment												
	Central Revenue Collection												
	Revenue Collection												
	Utilities												
Stations	Rail	na		na		na		na		na		na	
	Bus Shelters												
Vehicles	Revenue Vehicles												
	Non-Revenue Vehicles												
	Equipment/Parts												

* Includes maintenance management systems
na - not applicable

Source provides substantial information for asset management
Sources does not provide substantial information for asset management

Exhibit 4-4: Asset Coverage By Data Source for Tier 2 Operators

Operator		Alameda-Oakland		Benicia		Fairfield-Suisun		Napa Valley		Santa Rosa		Sonoma	
Asset Types		Fixed Asset Database	Misc. Sources*	Fixed Asset Database	Misc. Sources*	Fixed Asset Database	Misc. Sources*	Fixed Asset Database	Misc. Sources*	Fixed Asset Database	Misc. Sources*	Fixed Asset Database	Misc. Sources*
Facilities	Buildings			■		■		■		■		■	
	Parking / Lot Surface			■		■		■		■		■	
	Equipment			■		■		■		■		■	
Systems	Communications			■		■		■		■		■	
	Revenue Collection			■		■		■		■		■	
Stations	Shelters / Terminals	■		■	■	■		■		■		■	
Vehicles	Revenue Vehicles	■	■	■	■	■		■	■	■	■	■	■
	Non-Revenue Vehicles			■	■	■		■		■		■	
	Equipment/Parts			■		■		■		■	■	■	

* Includes maintenance management systems

■ Source provides substantial information for asset management
Sources does not provide substantial information for asset management

5.0 RESULTS – DATA QUALITY

The prior two chapters provided a review of (1) those data sources that Bay Area operators currently use to document their asset holdings and (2) the extent to which those sources cover the full range of assets utilized by each operator. However, neither of these prior chapters considered the quality of the data documented in each identified source.

For this chapter, the project team assessed the quality of the asset inventory related data sources maintained by each of the 21 regional operators. The most common data source analyzed is the fixed asset database, primarily used for accounting and depreciation purposes. As previously discussed in Chapters 3 and 4, nearly all regional operators have a fixed asset database and these represent the most comprehensive ***single existing*** sources of asset inventory information available. Hence, this source type represents the best short-term opportunity for development of a regional fixed asset inventory. Moreover, most of the region's operators were able to provide the study team with electronic copies of their fixed asset databases, thus facilitating detailed analysis of these sources. Where available in sufficient detail, the study team also conducted data quality tests of other agency sources as well.

A review of the quality of the data that the regional operators are maintaining is crucial to the assessment of regional asset inventory development using existing data sources. If the existing data are determined to be of sufficient quality for all, or at least most agencies, these sources are more likely able to support regional inventory development. If the existing sources are not of sufficient quality, MTC will more likely need to work with the region's operators to develop new sources or significantly improve the quality of existing sources.

5.1 Data Quality Review Approach

To complete this assessment of source data quality, complete data downloads were obtained from as many of the region's 21 operators as possible. As just noted, these downloads were obtained primarily from the agency fixed asset databases but in some cases downloads were also obtained from agency maintenance management systems and other miscellaneous sources of inventory data.

The quality of each of the submitted sources was conducted using analytical queries conducted within MS Excel and MS Access. These queries considered such questions as:

- What is the oldest and newest record maintained in the current database?
- By asset type, are the ages of the oldest assets reasonable given their expected useful life?
- Does the database record rehabilitations and replacements?

- Do the recorded acquisition costs appear reasonable?
- What is the minimum cost item recorded?
- Does the source include records of special studies, capital funding transfers or other capitalized "assets" that will not require rehabilitation or replacement?
- How frequently are the recorded data updated?
- What data fields does the data source report?

Once completed, the results of these data quality assessments were grouped into the seven categories of evaluation criteria:

- Data source and purpose
- Overall quality of the data
- Possesses data fields to support capital planning
- How current the data are
- Frequency of updates
- Records asset disposals / retirements, and
- Records new asset purchases.

Each of these criteria is addressed in more detail below:

Data Source and Purpose: This analysis (from Chapter 3) identifies the data source assessed, its purpose, and its appropriateness as a source of capital asset inventory data.

Overall Data Quality: Each dataset was evaluated for overall quality as being either good, fair, or poor. "Good" denotes data that was deemed to be current, complete, and accurate with few data gaps (the source covers most or all asset types). "Fair" denotes data that was deemed to be mostly current, complete and accurate with some identified data gaps (some asset types are not reported). "Poor" denotes data that was deemed not current, complete, or accurate and had numerous data gaps (source only covers a segment of the agency's asset holdings).

This overall assessment rating represents a summation of the results of many individual analyses conducted on the data sets provided. Among these were many of the evaluations identified above including identification of the oldest recorded assets by asset type (a test of whether retired assets are truly being documented as such), reasonability of cost data, whether non-replacement assets such as land and special studies are recorded and documentation of rehabilitation activities.

Capital Planning Data Fields: Required data fields for asset inventory development include, as previously mentioned in Chapter 3, a hierarchy of asset types, data on asset type, cost, unit quantities, acquisition date, and network location, and asset condition (or assessed remaining life). At the very minimum, the data included asset type,

acquisition cost, and acquisition date to be considered as having "All" required data fields. "Some" denotes having some of the required data fields, and "None" did not have any.

Are Data Kept Current?: Accurate capital re-investment needs analysis requires that the supporting data sources house data the accurately reflect each agency's current asset holdings (i.e., and not their asset holdings at some point in the past). Data was deemed current for purposes of this study if:

- Updates were made at least monthly / quarterly for large operators, and
- Updates were made at least annually or as needed for small operators.

Moreover, the data sets provided by the local agencies were queried to ensure that the information recorded was consistent with these update frequencies (e.g., that the sources include new records or revisions to pre-existing records each quarter).

Reporting Frequency: Frequency of updates is a measure of how often records or events were recorded in the active inventory list. Categories used to judge this criterion were annually, bi-annually, monthly, daily, and "as needed". For most non-vehicle asset types, annual updating is sufficient for the purposes of long-term capital needs analysis (as most transit assets have very long lives). Hence, updates at more frequent intervals should be more than sufficient for most capital analysis requirements. Moreover, frequent updating is a good indication of active data maintenance and hence superior data quality.

Recording of Asset Disposals / Retirements: For the purposes of conducting accurate assessments of future capital needs, it is crucial that the underlying data source (i.e., asset inventory) not include records of assets that no-longer exist (unless there is some means of identifying these assets as being disposed). Otherwise, the resulting needs assessment over-estimate rehabilitation and replacement needs for the owning agency.

Here, if disposal or retirement of assets was recorded in the operator's active inventory list, this column in the following tables was marked with a "Yes." If not, this column was marked with a "No."

Recording of Purchases: Similarly, it is crucial that the asset inventory sources document all assets recently purchased by each agency. If new assets are not represented in the inventory data sources, needs analyses conducting using this sources will necessarily ***under***-estimate rehab and replacement needs for the owning agency.

If a newly acquired asset was entered into the active inventory list, this column in the following tables was marked with a "Yes." If not, this column was marked with a "No."

5.2 Summary of Findings

The results of the data quality reviews are presented below in Exhibits 5-1, 5-2 and 5-3. Specifically, Exhibit 5-1 presents the results for the Tier 1 rail operators, Exhibit 5-2 presents the results for the Tier 1 non-rail operators, and Exhibit 5-3 presents the results for all Tier 2 operators. It is important to note that the evaluation of data presented in these exhibits is based on data sources provided by the 21 regional operators. A more thorough analysis is still ongoing of the actual data sets provided by each operator.

Exhibit 5-1 : Data Quality Assessment for Tier 1 Rail Operators

	Caltrain	BART	Muni	ACE	VTA
Data Source	Fixed Asset Database	Fixed Asset Database	Fixed Asset Database	Fixed Asset Database	Fixed Asset Database
Data Quality	Good	Fair	Good	Good	Fair
Do sources provide required data fields for asset inventory development?	All	All	All	All	Some
Are data current?	Yes	Yes	Yes	Yes	Yes
Reporting frequency?	Monthly or As Needed	Daily	Monthly	Daily	As needed
Are disposals / retirements recorded?	Yes	Yes	Yes	N/A	Yes
Are new records entered?	Yes	Yes	Yes	Yes	Yes

Exhibit 5-2: Data Quality Assessment for Tier 1 Non-Rail Operators

	AC Transit	CCCTA	Tri Delta Transit	GGBHTD	LAVTA	SamTrans	Vallejo Transit	WestCAT
Data Source	Fixed Asset Database	Fixed Asset Database	Fixed Asset Database	Fixed Asset Database	Fixed Asset Database	Fixed Asset Database	Fixed Asset Database	Depreciation Schedule
Data Quality	Good	Good	Fair	Good	Good	Good	Good	Good
Do sources provide required data fields for asset inventory development?	All	All	All	All	All	All	All	All
Are data current?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Reporting frequency?	Monthly	Daily	Annually or As Needed	Monthly	Annually or As Needed	Monthly or As Needed	Annually	Annually or As Needed
Are disposals / retirements recorded?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Are new records entered?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Exhibit 5-3: Data Quality Assessment for Tier 2 Operators

	Alameda-Oakland Ferry	Benicia Transit	Fairfield-Suisun Transit	Napa Valley Transit	Santa Rosa CityBus		Sonoma County Transit	Union City Transit	Vacaville City Coach
Data Source	Fixed Asset Database	Fixed Asset Spreadsheet	Fixed Asset Spreadsheet	Fixed Asset Spreadsheet	Facilities Maintenance Group Database	Maintenance Garage Database	Fixed Asset Spreadsheet	Fixed Asset Database	Fixed Asset Spreadsheet
Data Quality	N/A	Good	Good	Good	Good	Good	Good	Good	Good
Do sources provide required data fields for asset inventory development?	N/A	All	All	All	All	All	All	All	All
Are data current?	N/A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Reporting frequency?	N/A	Annually	Bi-annually or As Needed	Annually	As Needed	As Needed	As Needed	Annually	Annually or As Needed
Are disposals / retirements recorded?	N/A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Are new records entered?	N/A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The following sub-sections describe the study team's findings for each of the seven source data quality evaluation criteria.

Data Source and Purpose: The main data source used for this assessment was the operators' fixed asset database. For the Tier 1 Rail and Non-Rail Operators, this was often housed in a commercial off-the-shelf software program. Most Tier 2 operators maintained this data in a series of spreadsheets. As already discussed in detail in Chapter 3, these data are intended to support accounting and financial report needs and are only very rarely used to support capital needs analyses.

Overall Data Quality: As noted above, each dataset was evaluated for overall quality as being either good, fair, or poor based on whether the data were deemed to be current, complete, accurate, have few data gaps and not suffer from other issues (e.g., do not include records for assets that are not rehabilitated such as land or special studies). All but four of the 21 operators' data sources were assessed being in "good" condition, while three of the four remaining were assessed as "fair" (one agency, Alameda-Oakland Ferry, has not been evaluated yet).

Capital Planning Data Fields: Most of the Tier 1 regional operators and all of the Tier 2 operators maintain the minimum required data fields for asset inventory development (asset type, acquisition cost, and acquisition date). For some operators, this information was not a clear data field, but the data could be deduced by using other data fields such as year-to-date and accumulated depreciation. None of the region's operators currently maintains either asset condition or assessed remaining life values in either their fixed asset databases (which is not surprising given these sources accounting function) or in any other source which is ***comprehensive*** of their total asset holdings (although some agencies maintain such data for small segments of their asset holdings in databases maintained for this type of information).

Are Data Kept Current?: Given the criterion applied for current data, all of the 21 regional operators keep their data current. As noted above, this periodicity is not a major concern, as most transit assets types have useful lives that stretch over several

years or decades. Where this can be an issue lies in changes in agency vehicle fleet holdings, which can be significant following a major retirement or new procurement.

Reporting Frequency: Frequency of updates is a measure of how often records or events were recorded in the active asset inventory. The large Tier 1 operators updated their inventory lists at least monthly. The Tier 2 and smaller Tier 1 operators updated their asset inventory databases annually, or as needed, which sufficed as satisfying the criteria for current data.

Recording of Asset Disposals / Retirements: For the most part, retired records are flagged as such and removed from active inventory. Frequency of recording disposal and retirement of assets depends on the size of each operator, frequency of communication among internal divisions, and sometimes most importantly, the size of their staff. In some cases among the Tier 1 operators, retired records were not removed from inventory using a reliable and consistent methodology. For example, operators such as SamTrans and Caltrain would often find that inventory would be replaced without relevant staff adequately recording the event.

Recording of Purchases: Across the Tier 1 rail and non-rail operators, new assets are typically added to the inventory list, with relatively few errors observed. The smaller operators typically updated their asset inventory spreadsheets at least annually, usually at the end of their fiscal year or before an annual audit, or as events such as inventory acquisitions or retirements occurred. Because these operators are not purchasing new assets as frequently as the larger operators, updates are typically not needed very frequently.

5.3 Other Tests and Findings

The following paragraphs consider other trends and findings relating to the assessment of data source quality.

Minimum Recorded Value: From the viewpoint of developing a regional asset inventory able to support reliable regional capital needs analyses, it is crucial that the underlying data source record all capital assets in excess of some minimum value (e.g., $15,000). At the same time, the actual regional database should not record assets of too small value, as this makes the asset inventory costly to maintain. However, while many assets may have relatively low cost on a per unit basis (e.g., radios), their cumulative cost can be significant (i.e., represent a material share of the agency's capital needs).

Based on the study group's review, the minimum dollar value recorded in the asset databases for many of the Tier 1 regional operators was $5,000, although some of the smaller Tier 1 operators such as CCCTA tracked assets down to as little as $300. Tier 2 operators seemed to aspire to track all assets of ***any*** dollar value. Although doing so

seems like it would be a simple task and a good idea in theory for an agency with relatively few assets, this practice is problematic as it is more challenging to track smaller dollar value items due to loss, theft, or vandalism of the items. Several operators commented on this problem. This issue would often result in incomplete or missing data, or inventory being replaced without proper notation of the event.

Asset Categorization: Inventory development and maintenance is greatly facilitated by the presence of a logical asset categorization scheme, such as that suggested above in Exhibit 1-2. A good asset categorization scheme greatly simplifies the process of locating and modifying records for existing assets and data entry for newly acquired assets. Clear asset categorization by the local agencies can also significantly reduce the level of effort required (and likely related errors) to construct a good quality regional asset inventory.

For most of the Tier 1 operators, assets were categorized and easily identified, either through obvious categories, or a crosswalk that defined each category code. For ACE and GGBHTD, assets were linked to specific modes. This differentiation is of particular importance when maintaining inventory information for assets with differing needs, uses, and useful lives.

However, several of the sources from the larger operators suffered from insufficient cost breakdown detail, making it challenging to understand the parts of many classifications and project types. Insufficient asset breakdown for right-of-way assets was also observed, along with lack of meaningful condition information. Moreover, the data sources for the larger multi-modal operators do not always clearly identify which mode (e.g., rail, bus, or paratransit) a specific asset supports.

5.4 Conclusion

Based on these findings, it is clear that the existing data sources (in particular, the fixed asset inventories) are of sufficient quality to support development of at least an initial regional asset inventory. These sources provide at least the minimum required data fields, the fields are supplied with data that are updated periodically (and reliably), retired assets are marked as such while the purchase of new assets are properly recorded, assets are reported down to (and usually below) the minimum value required to support accurate capital needs analysis, and finally assets are reasonably categorized.

6.0 RESULTS – CAPITAL PLANNING PROCESSES

6.1 Transit Industry Capital Planning Processes

Transit agencies typically use their own methods and assumptions when determining their capital re-investment needs. In general, these processes can be thought of as falling into one of the following general types:

- Engineering Staff Based Needs (Static Analysis Process): For most transit agencies, Capital Improvement Plan (CIP) projections of rehabilitation / replacement needs represent a compilation of specific replacement / repair activities identified by agency engineers staff for specific assets at specific locations. These needs represent "on-site" engineering assessments of rehabilitation-replace activities based on direct observation by experienced engineering staff. These needs are typically prioritized to address those activities most in need of completion subject to available funding (based on the engineer's perceptions of relative needs). The benefit is that these estimates are based on a detailed engineering analysis of the entire asset base. The weakness is that the engineering analysis consumes a large amount of resources for a process that is only focused on that static point in time.

- Engineering-Condition Based Needs (Partially Static / Partially Dynamic): This approach (used at NYCT and some other large US operators) is similar to the approach above with the exception that engineering staff are requested to assign a condition value to each asset (similar to that used by FTA's TERM model). Capital budgeting staff can then use the condition data to help prioritize investments and also to assess progress over time. Asset condition is updated on an annual basis using a consistent evaluation process. The benefit of this process is that the engineering analysis determines a condition based value that can be used to establish replacement conditions more consistently across operators and asset types. The weakness of this process is the extensive amount of engineering resources necessary to develop and maintain this condition process.

- Capital Needs Models / Decision Support Tools (Fully-Dynamic): In contrast to the on-site engineering staff assessment approach, computer-based capital needs decision support tools (e.g., FTA's TERM model) provide a more dynamic assessment of rehabilitation and replacement needs by evaluating needs based on data recorded in a "capital planning ready" capital asset inventory. The condition values are estimated based on the deterioration experience of similar assets and the development of a

mathematical simulation of this process to limit the engineering efforts to a sampling basis rather than a comprehensive annual basis. Specifically, these models / tools use capital asset inventory data on capital asset types, ages, useful lives and life cycle needs to estimate current and future capital rehabilitation and replacement needs. It is important to emphasize here that the ultimate goal of developing a regional capital asset inventory for the Bay Area lies in being able to conduct just these types of dynamic capital needs analyses. These analyses are generally conducted by capital planning staff.

In practice, these three approaches are not mutually exclusive as any given agency may utilize any one, two or even all three of these differing approaches. From the viewpoint of this study, the interest lies in determining what approaches and data sources the regional operators are currently using in developing their capital plans. Of particular interest is the extent to which regional operators are currently using capital asset inventories and related data sources to support these processes. The more prevalent the use of either capital asset inventory data (or related analytically based capital needs analyses these data can support), the better able the region's operators will be to support development of a regional asset inventory. In contrast, to the extent that the region's agencies only utilize engineering based analyses of immediate re-investment needs (or do not use asset inventory data sources), these agencies may be less able to support regional inventory development, as they are not currently utilizing such data for their own internal needs.

The following section provides an assessment of those data sources currently used by regional operators in support of their capital planning efforts.

6.2 Data Sources Used by Regional Operators for Capital Planning

The use of data for capital planning processes at the Bay Area transit operators varies from agency to agency, but can largely be broken down into three major categories, with some overlap between the first two:

- Medium (100-400 vehicles) and large-sized operators (over 400 vehicles)
- Rail operators
- Small operators (less than 100 vehicles).

First, the medium and large-sized operators maintain a multiplicity of data sources that are used in the capital planning processes. These operators produce a variety of supporting documentation that are used in the preparation of their Capital Improvement Programs (CIPs). These operators use Fleet Plans, Facility Plans, Maintenance Management Systems, and more informal data sources maintained by the staff responsible for planning in the individual subject areas to construct their CIPs.

None of the medium and large operators except GGBHTD reported using their Fixed Asset databases for any capital planning purposes, other than a few who use it to establish in-service dates for vehicles as a one-time reference. In the medium and large-sized operators, staff maintaining the Fixed Asset database are usually in the Finance or Accounting groups, and are often not much involved in or very aware of the capital planning processes.

The second category is the rail operators, which in all cases except ACE, overlap with the medium and large-sized operator category. The rail operations in general have rigorous inspection processes for the track and power delivery infrastructures that result in detailed regular reports or State-of-Good-Repair databases that provide detailed information on needed capital projects, and feed into the capital planning processes. Indeed, maintenance and replacement of rail track, propulsion systems and signals are examples of safety and "mission-critical" infrastructure and systems that are non-negotiable in so far as the need to manage replacement needs.

As a result, the rail operators rely more on engineering assessments and reliability-centered maintenance in the capital planning processes than do the bus operators. These operators tend not to use the Fixed Asset databases for capital planning purposes. The one exception to this is MTA / Muni, which does not have a State-of-Good Repair database or have detailed regular engineering-led inspections and reporting of system conditions. Muni's infrastructure program is based more in assessments done by maintenance forces, coordinated through staff committees. These engineering assessments could be used to develop local operator condition values to help determine replacement and rehabilitation decisions across all operators and asset categories. For these condition assessment data to be consistent, however, they would need to be performed by all operators, each using the same standardized condition rating process (which they do not).

Finally, in the third category, small operators (less than 100 vehicles) produce fewer supporting studies in their capital planning processes, and more often rely on data in the Fixed Asset databases. Many of the small operators reported using their Fixed Asset databases as major sources of information for capital planning purposes. At the small operators, the Fixed Asset databases tend to be Microsoft Excel spreadsheets, and are often maintained by the same individuals performing the capital planning work; thus they are incorporated into the process more easily. Also, the smaller operators have many fewer items listed. The items listed in the Fixed Asset database are generally more comparable than at the larger systems, and can more easily be incorporated into the planning process.

The table below summarizes the major data sources for capital planning processes at each agency.

Exhibit 6-1: Data Sources for Capital Planning

	Internal Capital Planning Lead	Major Partners	Major Data Sources for CIP Development	Asset Data Used for Planning?
Tier 1				
ACE	Planning & Programming	Union Pacific, Herzog	Union Pacific Track Management System, HITS (Herzog MMS)	No
AC Transit	Capital Planning & Grant Administration	Facilities Maintenance, Vehicle Maintenance	Fixed Asset System, Ellipse (MMS), Vehicle List, Deferred Maintenance List	Vehicle in-service dates only
BART	Planning & Budget	Maintenance & Engineering, Rolling Stock & Shops	Fleet Management Plan, Facilities Maintenance Plan, Right-of-Way Condition Report, MP2, Track Maintenance Database, MARIS (MMS)	No
Caltrain	Capital Programming & Grants	Engineering, Rail Operations, Maintenance, Amtrak	State-of-Good-Repair database, Equipment Lifecycle Plan	No
CCCTA	Planning	Maintenance	Fixed Asset System, Vehicle List	Vehicle in-service dates only
ECCTA	Planning	Operations, contract operator	Fixed Asset Database	Yes
GGBHTD	Capital & Grant Programs	Bus Division (Maintenance), Marine Division (Maintenance)	HOBBES (MMS), Bus Fleet Replacement Plan, Ferry Fleet Replacement Plan, Facilities Maintenance Plan, Dredging Plan, CIP Database	Input to CIP database
LAVTA	Grants, Capital Projects & Procurement	Contract operator	Spreadsheets kept by GCP&P	No
SamTrans	Capital Programming & Grants	Maintenance	Base Inspection Report, 20-Year Plan	No
SF Muni	Capital Planning	Engineering, Maintenance	Fleet Management Plan (included in SRTP/CIP), Capital Planning Database, internal working committees	No
VTA	Programming & Grants	Rail Maintenance, Bus Maintenance	Plant Maintenance Module (MMS), Bus Replacement Plan, LRV Replacement Plan, Non-Revenue Vehicle Replacement Plan, Facilities Maintenance Plan, Right-of-Way Condition Report	No
Vallejo	Grants	Contract operator	Fleet Inventory Plan, HTE Fixed Asset System	Yes
WestCAT	Planning	Finance, contract operator	Fleet List	Vehicle in-service dates only
Tier 2				
Ala-Oak Ferry	Ferry Manager	Public Works, contract operators	SRTP	No
Benicia	Transit Services Manager	Contract operator	Capital asset spreadsheet, Vehicle Inventory List, Fleet Plan, Facilities Maintenance Plan	Yes

	Internal Capital Planning Lead	Major Partners	Major Data Sources for CIP Development	Asset Data Used for Planning?
Fairfield-Suisun	Transit Manager	Transportation, Maintenance	Capital Asset Database	Yes
Napa Valley	Fiscal & Planning	Maintenance	Fixed Asset spreadsheet,	Yes
Santa Rosa	Transit Superintendent	Facilities Maintenance, City Garage	Capital Asset Data	Yes
Sonoma County	Transit Manager, Planning	Maintenance	Fixed Asset Database	Yes
Union City	Finance	Maintenance	SRTP	No
Vacaville	Transit Manager	Maintenance	Fleet Inventory Asset Matrix	Yes

7.0 REGIONAL INVENTORY RECOMMENDATIONS

This chapter presents the rationale for structuring MTC's Regional Transit Capital Inventory. Consultant recommendations are organized around six key questions:

1. What is the recommended asset architecture for the inventory, in terms of asset level of detail?
2. What level of detail best satisfies MTC needs?
3. How able are Bay Area operators to reasonably furnish this level of asset data?
4. What is the best source of operator data to develop the regional inventory?
5. What other related technical questions exist?
6. What are the recommended next steps?

The end of this chapter contains a roll-up of all consultant recommendations.

7.1 Appropriate Inventory Level of Detail

The appropriate level of asset detail required by MTC for the regional inventory is a function of the types of capital analyses (e.g., 25-year regional needs forecasts) MTC wishes to perform. It is also a function of what is feasible and reasonable for the Bay Area operators to provide. In other words, the decision on the level of detail in the regional inventory should be based on a trade-off between analytic capability and the cost of collecting and maintaining the data. The higher level of detail available, the more accurate and comprehensive the capital rehabilitation and replacement projections can become.

The Booz Allen-URS team recommended using a three level architecture as basis of discussions with MTC and the operators to accomplish both objectives. This asset inventory architecture is illustrated in a two-page table, Exhibit 7-1, starting on the following page. The table illustrates three levels of detail for the inventory data:

- Level of detail 1 – This is the highest level, "strategic" level data
- Level of detail 2 – This is the mid-level of inventory information
- Level of detail 3 – This constitutes the most detailed inventory data.

Exhibit 7-1 contains seven major asset classes: guideway; railway/track; roadway; stations; facilities; systems; and vehicles. Ferry infrastructure such as docks has been integrated in the major asset classes.

Exhibit 7-1
Potential Asset Inventory Architecture for Varying Levels of Detail

GUIDEWAY	Quantity	Date Built	Grade	Surface	Alignment Type	Geologic	Location	
	Lineal Guideway Roadway Mile Cubic Feet	Date Built	At grade Below Above Depth / Dredging	Roadway Railway	Exclusive Semi exclusive Mixed traffic Tunnel Cut and cover Retained cut Elevated structure Elevated fill	Hard Soils Soft Soils Tube	Milepost Marker	
Level of Detail 1	→	→	→	→				
Level of Detail 2	→	→	→	→	→			
Level of Detail 3	→	→	→	→	→	→	→	

RAILWAY/TRACK	Quantity	Next Replacement Year	Track Class	Track Type	Alignment Type	Location	
	Track Mile	Next Replacement Year	Light Heavy Commuter	Ballast Embedded In Street Special	Yard Tangent Curve Station	Milepost Marker	Note: Track class based on maximum speed, weight and frequency of use, and related to FRA classes.
Level of Detail 1	→	→	→	→			
Level of Detail 2	→	→	→	→	→		
Level of Detail 3	→	→	→	→	→	→	

ROADWAY	Quantity	Date Built	Pavement Class	Pavement Type	Alignment Type	Location	
	Mile	Date Built	Local Arterial Highway Facility	Concrete Asphalt	Yard Tangent Curve Station	Milepost Marker	Note: Pavement class based on maximum speed, weight and frequency of use, and related to CBRT classes.
Level of Detail 1	→	→	→	→			
Level of Detail 2	→	→	→	→	→		
Level of Detail 3	→	→	→	→	→	→	

STATIONS	Quantity	Date Built	Size	Grade	Major Component	Minor Component	Platform	Material Types	Location
	Number	Date Built	Square Feet	At grade Below Above Subway	Structure Roof Canopy Platform Elevator Escalator Public address systems Destination signs Alarm systems Emergency backup system Access Facilities Auto Park Garage Auto Park Lot Kiss & Ride Bus Transfer Area Bike Ped. Overpass Ferry - Dock Ferry - Float Ferry - Moveable Gantry Ramp	Equipment Plumbing Electrical System HVAC Public toilets Landscape Mezzanine Station attendant booth	Side Center	Concrete Brick Wood Asphalt	Milepost Marker
Level of Detail 1	→	→	→	→					
Level of Detail 2	→	→	→	→	→				
Level of Detail 3	→	→	→	→	→	→	→	→	→

FACILITIES	Quantity	Date Built	Size	Type	Major Components	Equipment	Location	
	Number	Date Built	Square Feet	Maintenance Light Maint. Activities Heavy Maint. Activities Administrative	Alarm systems Backup power Cranes Electrical System HVAC Roof Parking/Circulator/Access Service Line Fuel Clean Revenue Structure Turntables Wheel presses Wheel truing machines	HVAC Dynamometer Lifts	Milepost Marker	
Level of Detail 1	→	→	→	→				
Level of Detail 2	→	→	→	→	→			
Level of Detail 3	→	→	→	→	→	→	→	

Exhibit 7-1 (Continued)
Potential Asset Inventory Architecture for Varying Levels of Detail

SYSTEMS	Quantity	Date Built	Type	Component	Element	Location	
	Mile Number of Units	Date Built	Train control	Fixed/wayside Moving block Communications based Centralized control Gates/crossing protection	Conduit Cable Relay rooms	Milepost Marker	
			Bus control	Traffic signals Gates/crossing protection Centralized control			
			Traction power	Power supply Substations Breaker houses Power distribution Catenary Third rail Transformers	 Conduit Cable		
			Communications	Voice-radio Data network	Radio Phones Base station Public announcement		
			ITS	GPS AVL CAD APC			
			Fare collection	Stations Vehicles Central revenue counting	TVM/add fare Turnstiles/faregates Fareboxes Coin Counters Bill Counters Ticket Encoders Translink		
			Utilities	Lighting Pump stations Subway pump system Ventilation	 Fans Dampers Control Systems		
Level of Detail 1	→	→	→	→			
Level of Detail 2	→	→	→	→	→		
Level of Detail 3	→	→	→	→	→	→	

VEHICLES	Quantity	Date Built	Revenue	Mode	Size	Propulsion Type	
	Number	Date Built	Revenue	Bus - Static Bus - Articulated Light Rail - Static Light Rail - Articulated Heavy Rail Commuter Rail - Single Level Commuter Rail - Bi Level Commuter Rail - Power Car Commuter Rail - Multiple Unit Auto Car Cutaway Locomotive Paratransit Van Trolley Bus Cable Car Ferry	1 - 10 10 - 20 20 - 30 30 - 40 40 - 60 60 - 80 80 +	Electric - Catenary Electric- Third Rail Diesel Gasoline CNG LP Bio-Diesel	
			Non Revenue	Auto Van Truck Light - Pickup Light - Other Heavy Special Vehicle Geometry Car Rail Grinder Other			
Level of Detail 1	→	→	→	→			
Level of Detail 2	→	→	→	→	→		
Level of Detail 3	→	→	→	→	→	→	

Under each major asset class are asset elements (e.g., quantity, age, type). The asset elements listed in Exhibit 7-1 are only intended to serve as a guideline in determining the appropriate level of detail for regional inventory, for each major asset class. Refinement of the elements within each major asset class should occur over time.

7.2 Asset Inventory Levels of Detail Versus MTC Needs

This section addresses the value to MTC, and potential level of analysis commensurate with each level of detail in agency capital asset reporting.

Benefits of the Proposed Asset Reporting Structures

While each of the levels of reporting detail presented in Exhibit 7-1 is appropriate for differing analyses and funding allocation objectives, they all have benefits in common. Adoption of any one of these levels of detail would ensure that all operators report their asset holdings on a common basis (i.e., at the same level of detail and using exactly the same structure). By doing so these structures support the objectives of fairness, equity, consistency, and transparency in the asset reporting process.

Asset Inventory Support for MTC's Current Points-Based TCP Process

The current TCP process (see Chapter 1) assigns priority rankings to projects based on investment type. For example, investments in fleet vehicles are ranked with 16 points whereas reinvestment in maintenance facilities is ranked at 12 points. MTC then uses these point rankings to allocate available capital funds, with investment prioritized to projects with the highest points.

To adequately inform the TCP process going forward, a regional asset inventory must provide sufficient asset detail to identify re-investment needs for the ***lowest*** level of investment points to be ranked. Hence, if MTC wishes to prioritize the allocation of funding down to the level of fare collection systems (for example), then the asset inventory should document current regional investment in this asset type (including quantities, replacement costs, and age distribution) as well as for investments in all assets rankings equal to or higher than that for fare collection systems. With the exception of revenue vehicles, MTC does not currently possess sufficient data to effectively support this process, underscoring the need for better capital asset data.

Potential MTC Analyses with Level of Detail

Exhibit 7-2 provides specific examples of the types of MTC analysis possible with a given level of inventory detail.

Exhibit 7-2
Level of Reporting Detail: Supportable Analysis and Limitations

Level	Supportable Analysis, Limitations and Recommendation
Level 1	- ***High Level, Strategic Analysis:*** Data at this level of detail could be used to estimate the relative ***gross*** capital needs of each regional operator. Operators would report facility needs by type of facility, but not major components such as roof, structure, etc. MTC could use this framework to compare the magnitude of all facility needs between operators. For track the inventory would include track miles by track type (ballasted, in street), but not distinguish between curve and tangent track (which have vastly different wear rates and replacement costs). - ***Key Advantages:*** (a) This is the easiest level of detail for agencies to report. (b) The Level of Detail 1 inventory would be the most rapid to build. (c) MTC would have at least some representative information in all major asset categories. - ***Limitations:*** (a) MTC would not have any insight into any of the major components beyond Level of Detail 1. (b) Developing orders of magnitude unit costs for asset replacement at this level would be extremely challenging. (c) For many asset types, this level of detail would not provide sufficient information to project, even at a gross level, future capital needs. - ***Recommendation: The consultant team does not recommend this Level of Detail for the inventory.***
Level 2	- ***Mid-Level, Asset Type Level Allocation:*** This increased level of detail would support the general prioritization of investment needs by asset type but well above the level of specific projects as would be identified by agency engineering staff. - ***Key Advantages:*** (a) The information generated through this level of reporting strikes a reasonable balance between level of detail and supportable analytic reporting capability. (b) MTC would be able to appreciate and evaluate the inventory and identified needs at the major component level. For instance in Systems MTC would not only be able to assess all major system types such as

Level	Supportable Analysis, Limitations and Recommendation
	train control, bus control, traction power, but also within traction power evaluate relative needs in power supply (e.g., substations, breaker houses) versus distribution (e.g., catenary, third rail). (c) This level of detail would encourage the operators towards more commonality in reporting replacement needs. (d) Level of Detail 2 reporting would also provide MTC with sufficient granularity in the data to forecast replacement needs over 10, 20 or 25 years as desired for the Regional Transportation Plan. - ***Limitations:*** MTC would not be able to evaluate specific projects, nor would MTC be able to pinpoint replacement needs to physical sections of the operator's infrastructure (e.g., milepost marker). - ***Recommendation: The consultant team recommends this level of detail for the inventory for all major asset classes but Vehicles.***
Level 3	- ***Detailed Needs Analysis:*** This level of detail would provide a very detailed analysis of individual operator needs by asset type and by asset location. This level of detail borders on the level of understanding used by agencies themselves to identify and budget for specific re-investment projects. - ***Key Advantages:*** (a) The information generated through this level of reporting provides the most robust inventory down to sub-element and location. (b) For Vehicles, all Bay Area operators already report this Level of Detail information to the FTA. Integration of this information with Finance Plan would be straightforward and directly useable by MTC. - ***Limitations:*** (a) It is unclear that from MTC's perspective, that the additional level of detail would provide very much added value compared to Level of Detail 2. (b) The costs for MTC and for the operators to collect and maintain this level of information would be, in some cases, very challenging. The amount of primary data collection required for some operators would be significant. - ***Recommendation: The consultant team recommends Level of Detail 3 for Vehicles.***

To more easily conceptualize Exhibit 7-1, and the expected level of detail for each major asset class, the consultant team developed a representative listing of assets for the recommended levels. The listing, which is shown in Appendix C, shows typical combinations of fields for major asset classes. The fields listed on the left hand side of the table refer to attributes of the asset class; the fields listed to the right refer to variables that the operators would fill in.

The next section addresses the other side of the "Appropriate Level of Detail" question, from the part of the Bay Area operators, namely what is feasible and reasonable for the operators to provide to MTC.

7.3 Appropriate Level of Detail for Operators to Provide

High-Level Assessment

Based on all the operator surveys held in the Fall and subsequent discussions, the consultant team estimated how close the Bay Area transit agencies are to being able to provide the necessary input to a regional capital asset inventory given the asset architecture in Exhibit 7-1. This high-level assessment is shown in Exhibit 7-3, below.

Exhibit 7-3
Operator Ability to Populate Regional Inventory

	Estimated Ability to Immediately Populate Inventory for All Asset Types		
	Level of Detail 1	**Level of Detail 2**	**Level of Detail 3**
Tier 1 Operators			
ACE	Yes	Yes, but not for Track	For vehicles and stations
AC Transit	Yes	Yes	For some assets
BART	Yes	Yes	For some assets
Caltrain	Yes	Yes	For some assets
CCCTA	Yes	Yes	Vehicles only
Tri Delta Transit	Yes	Yes	Vehicles only
GGBHTD	Yes	Yes	Vehicles only
LAVTA	Yes	Yes	Vehicles only
Muni	Yes	For some assets	Vehicles only
Samtrans	Yes	Yes	For some assets
City of Vallejo Transit	Yes	Yes	For some assets
VTA	Yes	Yes	For most assets
West CAT	Yes	Yes	Vehicles only
Tier 2 Operators			
City of Alameda Ferry Program	Yes	For vehicles but not facilities	Vehicles only
Benicia Breeze	Yes	For vehicles but not facilities	Vehicles only
Fairfield-Suisun Transit	Yes	For vehicles but not facilities	Vehicles only
Napa Valley Transit	Yes	For vehicles but not facilities	Vehicles only
Santa Rosa City Bus	Yes	For vehicles but not facilities	Vehicles only
Sonoma County Transit	Yes	For vehicles but not facilities	Vehicles only
Union City Transit	Yes	For vehicles but not facilities	Vehicles only
Vacaville City Coach	Yes	For vehicles but not facilities	Vehicles only

The assessment is as follows:

- Ability to meet Level of Detail 1 – All operators should be able to populate an inventory at this level of detail.

- Ability to meet Level of Detail 2 – Most Tier 1 operators should be able to provide inventory data at this level, with exceptions for ACE and MTA / Muni. Tier 2 operators are expected to be able to populate Level of Detail 2 inventory for vehicles, but not for facilities

- Ability to meet Level of Detail 3 – About half the Tier 1 operators can feasibly and reasonably report on this level of detail currently. The Tier 2 operators are able to report at this level of detail for vehicles only.

Detailed Assessment

The consultant team also developed a more detailed assessment of operator-by-operator ability to report on differing levels of detail for the regional capital inventory. This assessment was made based on the surveys with all the operators, subsequent discussions, and consultant team analysis of capital asset data provided during the course of the project.

The detailed assessment is provided in Appendix D Matrix. For the most part, the assessment validates the summary presented in Exhibit 7-3. ***This analysis confirms the consultant team recommendation of reporting Level of Detail 2 for most major asset classes and Level of Detail 3 for vehicles.***

Gap Analysis for Recommended Level of Detail

Where appropriate in the Appendix D Matrix, the consultant team identified the best source of data by name. There are a number of fields for which there is no known source of data (i.e., units, age / expected replacement year, useful life, major component). Reasons could include:

- Operator does not maintain these fields for certain asset categories
- Data are kept in manual or secondary sources – inventory data would represent a relatively minor effort to collect
- Data may be kept in manual or secondary sources, but are hard to retrieve – reporting would likely entail major effort including primary data collection.

In some cases, an asset may be owned by another party (e.g., track for ACE is owned by Union Pacific Railroad). When the identified source of data is the agency's Fixed Asset

Database, the actions needed to meet the desired level of detail may simply be the labor to extract the required information.

The following detailed assessment, Exhibit 7-4, points to the following observations for Tier 1 operators.

Exhibit 7-4
Operator Gap to Populate Inventory

Operator	Top Actions Needed to Meet Level of Detail 2 for Most Asset Classes and Level of Detail 3 for Vehicles
ACE	- Negotiate with UPRR so that ACE can gain access to guideway, railway/track, and systems and station data necessary for inventory - Collect/convert UPRR datasets - Collect/create data for facility major components, equipment, and location - Collect/create track alignment type data - Collect/create systems type and component data
AC Transit	- Develop facility and systems inventories and age/useful life assessments consistently for Level of Detail 2 (may require some primary data collection and extraction of data from manual sources) - Add Vehicle passenger capacity data to Ellipse - Develop useful life measures for all non-vehicle classes - Develop age and useful life information in Ellipse
BART	- Convert Track Department documentation into RTCI format - Convert available Station and System from MP2 to RTCI format - Collect data from secondary sources for some Systems (ITS, substations)
Caltrain	- Create new database or modify SOGR database to keep all vehicle information in one location - Add new maintenance facility to SOGR database
CCCTA	- Develop square footage of facilities - Collect/create data for Facility major components (including age and useful life)
Tri Delta Transit	- Develop Facility and Systems information to Level of Detail 2 - Develop useful life measures for all non-vehicle classes - Develop age and useful life assessment information
GGBHTD	- Extract Level of Detail 2 data from IFAS and Ferry Division for channel dredging, docks and stations (and components) - Extract data from Engineering Department manual databases for facilities, and systems. Some primary data collection (age, useful life) is likely for Facilities and Systems.
LAVTA	- Break down Facility major components (including age and useful life information) - Collect/create Systems quantity and component data consistent with the RTCI format
Muni	- Collect inventory/condition assessment information (primary data collection) for Level of Detail 2 for Guideway, Track, Systems, and Stations - For Systems, both of Level of Detail 1 and 2 is likely to require significant collection of secondary sources and primary data collection - Develop useful life measures for all asset classes - Extract Communications and ITS data from Fixed Asset Accounting Control System - Extract Level of Detail 2 data from DPW/Facility Renewal Resource Model for Facilities and match RTCI format
Samtrans	- Document facility and systems inventories and age/useful life assessments for Level of Detail 2

Vallejo Transit	- Break down facility major components (including age/useful life) - Collect/create systems basic and component data - Collect/create vehicle size data - Collect/convert datasets from Contractor
VTA	- Inventory Plant Maintenance Module for extraction of fields to match RTCI format - Supplement Station and Systems data by extracting secondary sources and some primary data collection
WestCAT	- Document Facility and Systems inventories and age/useful life assessments for Level of Detail 2 - Vehicle length information needs to be added to Fleet List

7.4 Best Sources of Inventory Data

On the existing sources of capital asset data, the survey clearly indicated that:

- "True" capital planning-ready asset inventory systems are rare – only one agency currently has the basis for such a system.
- All Bay Area operators have a fixed asset database, but these are primarily used for financial accounting and reporting.
- Maintenance management systems (MMS) are in use by most transit agencies; medium and large systems use commercial products. These systems frequently contain good quality asset inventory data but typically only document a sub-segment of each agency's total asset holdings (usually vehicles), and may not contain all of the information on each asset desired in an asset inventory. In other cases, the level of detail in an MMS can be far greater than desired in an asset inventory, in terms of cataloging every individual part and component separately.
- Key capital asset replacement and rehabilitation information is contained in a variety of other sources maintained at each agency, such as fleet replacement plans, condition assessments, and a variety of specialized department sources.

Coverage of sources is best for the fixed asset databases. The other miscellaneous sources of asset inventory information, taken together, only cover a fraction of the transit agency total holdings in the region. However, while fixed asset databases cover the vast majority of asset types, data are sometimes aggregated into elements that are too large or broken down at a level of detail that is far too detailed for MTC's purposes.

The consultant team performed a high level quality check of fixed asset databases (and, to some degree, other supporting databases) for a representative sample of large, medium and small Bay Area operators. The conclusion reached was that the fixed asset databases reliably provide at least the minimum required data fields required for an initial regional asset inventory.

Based on these findings, MTC is faced with two basic options for development of a regional capital asset inventory:

1. Use scrubbed data from the fixed asset databases (i.e., cleansed to remove unwanted records and adding in required detail)

2. Develop the regional inventory using a combination of existing data sources and primary data collection.

Using Fixed Asset Databases

Fixed asset databases appear to represent the best ***single, existing*** source to develop a regional transit asset inventory. Once again, each of the MTC operators has some form of fixed asset database and these sources are nearly comprehensive of all agency assets.

However, as already noted, fixed asset inventories also have many significant limitations, the most significant of which is an inconsistent level of detail across operators (i.e., some operator records are extremely detailed and others group multiple assets into a single "lump sum" record). The level of recorded detail can also vary significantly within a single database. Other key issues include poor categorization of assets, the presence of records that do not represent assets with actual replacement needs (e.g., land, capitalized studies, and remodeling records) and the general absence of any asset quantity data (e.g., number of feet of track work, facility size, number of vehicles).

Given these limitations, each agency's existing fixed asset database would require considerable data cleansing, modification and ongoing maintenance for use in MTC's capital planning process:

- Identification and segmentation of grouped asset records: Records where multiple assets with differing asset life cycles are grouped (e.g., rail line investments that include train control, electrification, trackwork and other assets within a single database record) would need to be identified and segmented into their constituent components.

- Placement of assets within meaningful asset categories: Cases where asset records are reported at such a fine level of detail, that it is not always clear which asset category (or mode) the asset belongs to. All asset records, but most notably these very detailed records, would need to be assigned to the relevant asset categories (e.g., facilities, guideway / trackwork, stations, vehicles, or systems) and likely sub-categories. The varying levels of recorded detail within each operator's asset inventory raise consistency concerns. For the regional inventory

to be successful, it should be viewed as being consistent and complete across all operators and thus capable of providing consistent analytic results across the region. This issue is particularly pertinent to fixed asset databases where the level of reported detail not only varies significantly ***among*** agencies but also ***within*** an individual agency's own fixed asset database.

- Identification and categorization of records for assets with no direct "replacement needs" (e.g., land, capitalized studies, and records documenting rehab and remodeling activities): Given that many of these databases, particularly those of the larger rail operators, house thousands of records, this refining process represents a fairly time consuming process.

- Expansion to include quantity data: Most fixed asset databases do not include data fields identifying the quantity of assets purchased. In most cases the amount is clearly a single unit amount. However, in cases such as track work, the availability of only a lump-sum dollar amount (also without reference to location within the rail system) will yield challenges in both the estimation of replacement needs and future database maintenance.

Having completed these and perhaps other data preparation tasks, the operator would need either to (1) maintain this information as a separate cleansed dataset (i.e., somehow separate from the fixed asset data source) or (2) modify the structure of the fixed asset databases (e.g., add additional fields) to demarcate the cleansed data from the remainder of the fixed asset database records. The first solution (1) is affected by the further challenge that this cleansing process would need to be repeated periodically (i.e., once every one to two years) to keep the modified dataset current (i.e., remove retired assets and add new assets). Hence, this approach has significant issues relating to the ongoing maintainability of the cleansed dataset. The second suggested approach (2) avoids this issue by modifying the field structure of the operator's existing fixed asset database (i.e., and keeping the modified data within the fixed asset database), but requires the operators to make substantial changes to both the current record entries and overall field structure of their fixed asset databases. This could require considerable internal coordination at the transit agencies to implement.

Many of these observations apply to other potential data sources as well (i.e., the need to modify existing data sources to suit the specific needs of capital planning analysis and to maintain a consolidated, central record source). The specific challenges with the fixed asset databases are (1) the presence of thousands of records, (2) the processes used to populate this data source (accounting of financial transactions), and (3) the outlook, knowledge and responsibilities of the staff populating this source (accounting versus staff responsible for operation and maintenance of transit assets). In contrast, other agency data sources are typically maintained by staff responsible for specific groups of

agency assets and hence are in a better position to maintain and report capital planning related data (e.g., asset condition or wear, recent rehabilitation activities).

In late January 2007, the consultant team and MTC met with the RTCI Working Group to present the Interim Report and solicit feedback on modifying the operator fixed asset databases as a "short term" solution. A second meeting was held with the rail operators in February 2007. The overwhelming consensus received from the operators about using fixed asset databases as the basis for developing a regional transit capital inventory was negative. The main reasons advocated were the extreme time-consuming effort to modify the fixed asset databases, and the technical challenges in extracting the desired level of analysis.

Given the many challenges identified above, including the reaction from the operators, the consultant recommends that MTC not adopt use of modified fixed asset databases as the primary local operator data source for development of the regional capital asset inventory. As noted in discussions with MTC and local operator staff, if the fixed asset databases substantially met the requirements for capital planning activities, the operators would already be using these sources for their own capital planning exercises - most do not.

Building from Existing Data Sources

Since the local operators' remaining data sources (e.g., maintenance management systems, secondary asset sources) fall well short of providing comprehensive asset coverage, it follows that development of a regional capital asset inventory must build from the existing sources. Developing a new inventory database would require leveraging a variety of asset information sources, including primary sources such as fixed asset databases and maintenance management systems, and secondary sources such as manual spreadsheets. The solution will be somewhat different for each operator. In some cases, as discussed in section 7.3 and illustrated in the Appendix D Matrix, primary data collection would be required.

The consultant team recommends that MTC's regional transit capital inventory be built using this approach of building from existing data sources, including primary data collection where appropriate.

7.5 Technical Considerations

In thinking through the inventory implementation, MTC and the regional operators should also consider the following technical questions:

1. What impact should anticipated changes to FTA's NTD reporting requirements for agency asset holdings have on establishing the regional asset inventory?

2. How should MTC approach the current RTP update given recommendations on the regional inventory structure?

3. What should be done to ensure seamless integration of operator data into Finance Plan?

4. What are the consultant team recommendations regarding reporting asset age, age- versus condition-based replacement, lifecycle, and rehabilitation?

Each of these issues is considered in turn.

Future FTA's NTD Reporting Requirements

FTA has been considering revising its National Transit Database (NTD) reporting requirements such that agencies will be required to report on the quantity and ages of their primary transit assets (see Exhibit 7-5 below). These proposed changes would apply to all operators receiving Section 5307 or 5309 funds. At present, agencies are required to report both age and quantity data for the revenue vehicles. Asset counts are also required for stations, track miles and facilities, but no age data is required.

The revised reporting requirements, which have a better than 50% chance of taking effect in the next few years, would likely require reporting of quantity, age, and replacement cost data at a level of detail similar to that reported at the Level of Detail 1 in Exhibit 7-1. FTA would require reporting on guideway structures (bridges, elevated structure and tunnels), trackwork, administrative facilities, maintenance facilities and equipment, revenue and non-revenue vehicles, stations, parking lots and garages, fare collection equipment, train control systems, traction power systems (third rail, catenary, substations), communications systems and some additional items.

Exhibit 7-5
Expanded FTA Reporting - Sample Screen for Maintenance Facilities

Maintenance Facilities

Jump to Instructions | Print | Insert Row

Press "Insert Row" button to enter additional facilities

Jump to Replacement Cost Instructions

	Facility Name	Year Built	Square Feet	Year of Last Life Extending Rehab	Apply "Codes": Remaining Useful Life (1-5)	Primary Mode	Ownership (1-6)	Maint Facil Type (1-6)	Estimated Total Cost to Replace Excluding Right-of-Way (Ownership = 1,3,5 Only) Selected Year Dollars: Replacement Cost	Selected Year $	Apply "Index": Cost Index	Description	Cost in 2002 Dollars: Dollars	Cost/ SqFt
	c	e	g	i	l	n	p	r	u	w	z			
1	Maint St Garage	1960	175,000	1990	2	MB	1	4	$ 50,000,000	1997	5	ENR/Building Cost Index	$53,797,319	$307
2	Front St Garage	1970	50,000	1995	1	MB	1	3	$ 2,000,000	1970	5	ENR/Building Cost Index	$8,659,052	$173
3	Oak St Garage	1960	100,000	1990	1	MB	1	4	$ 10,000,000	2002$?			$10,000,000	$100
4	First St Garage	1980	150,000	None	1	MB	1	4	$ 30,000,000	1995	9	BLS/Non-Residential Bldgs	$32,188,494	$215
5	Enter Facility Here 1st, then Columns e - ai													
6	Enter Facility Here 1st, then Columns e - ai													
7	Enter Facility Here 1st, then Columns e - ai													
8	Enter Facility Here 1st, then Columns e - ai													
9	Enter Facility Here 1st, then Columns e - ai													
10	Enter Facility Here 1st, then Columns e - ai													

NO BAD DATA
NO MISSING DATA
Error Status Messages are in the box above & are summarized in 'Error'

Since FTA is likely to adopt this new reporting requirement, Bay Area operators have an interest in ensuring that the MTC regional asset reporting structure is as detailed as, and compatible with, the FTA structure. The consultant team has provided MTC with a copy of the asset structure already "beta tested" by FTA for this purpose and which is also considered representative of the structure FTA would most likely adopt for this expanded reporting requirement. The three data inventory options presented in Exhibit 7-1 are consistent with this FTA inventory structure.

The consultant team does not recommend simply using the FTA proposed database structure for the MTC regional inventory. Based on the 2002 beta-test, the FTA structure does not fully meet MTC's needs on several counts. First, within the FTA structure maintenance facilities and passenger stations are only reported as single assets. In other words, the FTA structure does not report on the age or condition of facility or station major components – such as roofing, HVAC, structure, parking surface, or platform. This level of reporting detail may make sense at the federal level (covering thousands of facilities and stations) but would not provide MTC with sufficient understanding of regional investment needs (e.g., for re-investment in parking structures, platforms, HVAC systems). Second, while the rough distribution of remaining useful life in to quartiles may be the only reasonable reporting approach for many Bay Area assets, this level of age/condition detail provides only a very grainy picture of regional investment needs. Specifically, this level of age detail cannot be used to assess differences in investment needs from one-year-to-the-next and, for longer lived assets (those with lives of 30 or more years say), will not be able to clearly determine differences in needs from one five-year period to the next.

The fact that FTA is likely to require this data from the transit operators lends support to MTC's efforts to develop better data on assets. Many agencies will need to improve internal data sources in order to comply with FTA's process, and MTC's process can both benefit from and assist operators in compliance with FTA's requirement.

RTP Development

In the summer of 2007, MTC will initiate its next cycle of RTP development. MTC expects to reach a decision on a selected capital asset reporting framework for this RTP cycle. The asset list provided in Appendix C provides a sample format of the desired level of reporting for this RTP cycle. In the appendix, each major asset class is covered by a separate page.

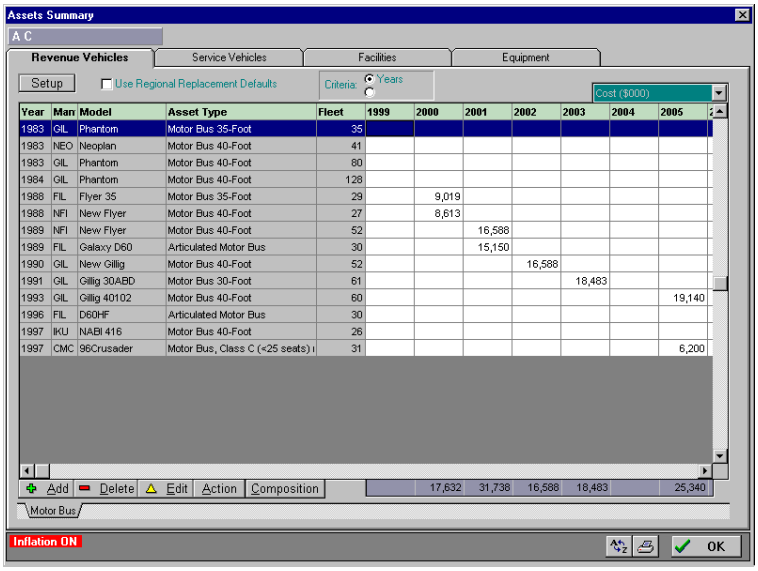
The Final Individual Operator Reports developed during the course of this project phase contain recommendations specific to each operator on how to populate the recommended structure identified in this Chapter.

The consultant team recommends that MTC request operators to submit RTP data in the recommended format (i.e., Appendix C) to the extent possible.

Finance Plan as a Reporting Tool

Finance Plan is currently MTC's tool for capturing the region's capital asset data for the transit operators. This was meant to be an asset database tool, but it is not currently used as such for all assets. MTC has specified that regional transit capital inventory data must feed into Finance Plan. The consultant team has taken the approach that it is best to focus on the capital asset information needed for decision making rather than focusing on a particular tool. Information coming out of the tool will only be as good as the operator inputs into the tool.

Exhibit 7-6
Finance Plan Assets Summary Page



With the upcoming update of the RTP in the summer of 2007, Finance Plan should be capable of supporting MTC with the enhancement of the asset inventory and the estimation of regional funding needs. The development of a new reporting tool or the more extensive enhancement of Finance Plan for this update would not be helpful to the results and could distract from the benefits of the inventory improvements. The development of an enhanced reporting tool can be more closely examined upon the completion of the 2007 RTP.

Some of the issues identified by the transit operating agencies as shortcomings of Finance Plan are due to the fact that Finance Plan is set up to accept data as an asset inventory, and many operators have input project summary information, instead. This requires "fixes" for the data entry to make it acceptable to Finance Plan from the perspective of capturing the cost, but not resulting in a true asset inventory. As

operators are able to disaggregate project-level data into asset-level data, this situation should improve.

The consultant team recommends that as the regional inventory initiative progresses, that sufficient effort (advance planning, spreadsheet design, training, etc) be applied to the data feed into Finance Plan to make the integration as seamless as possible. To the extent possible, operators should be encouraged to disaggregate project level data into asset inventory data.

Consultant Recommendations Related to Age, Lifecycle, Rehabilitations

Detailed Age Reporting Versus Simplified Approaches

Accurate estimation of the region's capital needs requires the ability to forecast when individual transit assets will require either rehabilitation or replacement. Typically this analysis relies on documentation of current asset age (or date built) but can also utilize other measures (e.g., vehicle miles, assessed condition) for which age is often a proxy. While not an issue for most asset types, detailed age reporting for "continuous assets", such as rail and catenary systems, can require the collection of literally hundreds of asset records.

Many options exist to simplify age reporting for these asset types including: (1) just report the age distribution for these assets (i.e., proportion within the first, second, third and forth quarter of useful life, and the proportion exceeding useful life); (2) report only the median or "dominant" age of those assets between major mile posts (based on the date of last major replacement), then estimate needs assuming all components have this age; and (3) avoid any collection of age data and just assume that a fixed share of these assets are rehabbed / replaced each year (e.g., for an asset with a useful life of 10 years, just assume one tenth is replaced each year). Of these options, (2) minimizes the loss of valuable age information and will yield the most accurate assessment of needs. It also limits to a reasonable level the amount of primary data research that the transit operators would need to do to complete the asset inventory initially.

The consultant team recommends detailed age reporting to the extent possible. The consultant team recommends reporting the median or "dominant" age approach – if operators are unable to furnish detailed asset age data.

Documenting Asset Life-Cycle Costs and Decision Points

In addition to asset age, forecasting ongoing regional capital needs also relies on an understanding of the life-cycle investment needs for all asset types. This includes identification of both the timing and cost of all life-cycle activities (rehabilitation, replacement, and annual capital maintenance) and the key drivers of the asset life cycle (e.g., age, life-to-date miles or hours of service, maintenance history). ***The consultant team recommends that collection and development of life-cycle data proceed in conjunction with***

collection of the asset inventory data and that agencies report the life-cycle variables identified above. It is expected that MTC will provide the operators a reference manual containing industry standard values for each asset category to use as defaults. Operators should be able to override default values if their cycles or costs differ from the defaults.

Cost Considerations

The costs recorded for each asset type need to reflect the complete capital cost of asset re-investment. In addition to the per unit acquisition cost paid to vendors, unit cost values should also include agency labor costs (design, installation and project management) as well as the cost of external professional services associated with vehicle designs, specifications, testing, and startup. Indirect, "soft-costs" such as project management can either be combined with the unit cost values into a single, "complete" unit cost estimate, or reported separately as a soft-cost overhead percentage amount. ***The consultant team recommends that unit capital costs should be inclusive of all costs including indirect or "soft costs" (e.g., design, project management). Note that the industry costs provided in the reference manual are not likely to include soft costs. These can be added later as a percentage (note, soft costs are typically not included in the as-built/final-purchase costs for most project elements).***

7.6 Next Steps

The consultant team, working in partnership with MTC and the Bay Area operators, has successfully completed the first phase of the RTCI initiative. The recommendations are summarized in Exhibit 7-7.

Exhibit 7-7
Summary of Consultant Team Recommendations

1. Use three level architecture as basis for discussions to accomplish objectives of: (a) determining appropriate level of inventory detail for MTC; and (b) determining appropriate level of inventory detail for operators.
2. For MTC and the operators, select Level of Detail 2 for all major asset classes but Vehicles, and select Level of Detail 3 for Vehicles. Specific actions to address gaps for the recommended level of detail are identified in the report.
3. Do not adopt modified fixed asset database as the primary [or principal] local operator data source for the regional inventory.
4. Build instead from existing local operator data sources, including a combination of primary sources (fixed asset database, maintenance management systems), secondary sources, and data collection where appropriate.
5. Do not select the anticipated FTA NTD structure as a structure for the RTCI – it is not detailed enough. The recommended RTCI structure does, however, satisfy

anticipated FTA NTD reporting requirements.
6. MTC should request operators to submit RTP data for the current cycle in the recommended format (i.e., Appendix C) to the extent possible
7. MTC should ensure that sufficient effort (advance planning, spreadsheet design, training, etc) be applied to the data feed into Finance Plan to make the integration as seamless as possible.
8. Following are recommendations on several key technical issues: a. Wherever possible, operators should provide detailed reporting of asset ages versus a simplified approach. Operators should use as many records as needed. When detailed age reporting is impractical (e.g., trackwork), operators should report as much age related data as possible, such as the median age between mileposts. b. Collection and/or development of life cycle data should proceed in tandem with the development of the asset inventory data. c. Unit capital costs should be inclusive of all costs including indirect or "soft costs" (e.g., design, project management)

MTC is planning a second phase of the RTCI project to improve transit operator capital inventories. This will be an opportunity to further the implementation of the framework in very specific ways; improve data systems and procedures; and provide operators various kinds of technical assistance related to RTCI implementation.

The collection and maintenance of this data will represent a different reporting requirement for the operators. Instead of reporting capital needs by reporting projects, operators will report replacement and rehabilitation needs by major asset category. The recommended asset classification system is based directly on FTA's Standard Cost Categories (SCC) but is more detailed than FTA's structure. This additional detail is recommended to conduct analyses at the level of detail necessary to prioritize regional funding needs. Data reported using the proposed asset classification system can be easily rolled up to the SCC structure and thus used for potential future NTD capital asset reporting requirements. Finance Plan will continue to be used as the modeling tool for RTP projections.

The Bay Area transit operators stand to gain a lot from MTC's efforts. Operators will gain valuable knowledge and the individual operator capital needs evaluation will be strengthened. Most of the challenges are expected in the initial development of the regional inventory, which might take several years – updates will be far less demanding. The process has the added benefit, for the operators, of preparing them for anticipated changes to FTA NTD reporting requirements.

The consultant team identified three general development areas for MTC to consider:

1. Framework Refinement. The consultant team has already recommended a detailed architecture and framework for the regional inventory. The next phase should address how to handle exceptions or unique assets (e.g., in Systems) that may not neatly fit within the proposed model. None of these are likely to change the proposed architecture, but will clarify for the operators, how to classify their assets and where to report the information.

2. Operator Operational Support. Phase I of the RTCI initiative has identified the operators most likely to require assistance. Operational support (or technical support) could help guide the operators to identify and modify internal reporting systems to support the asset database development and maintenance. Technical support could also guide the operators in how best to collect this data where none exists currently (specifically, MTC could work with operators to strategize and conduct primary data collection).

   MTC will need to begin by refining the evaluation of inventory efforts needed for each asset type. Providing support to those larger operators not currently well prepared to report the desired level of detail should be the focus of MTC's operational support. MTC should also evaluate smaller bus operator reporting needs and act accordingly. However, it is not expected that these operators will require much assistance in this process as their asset bases are more easily documented.

3. MTC Operational Support. MTC can pursue a variety of operational support activities, such as program oversight, data validation processes, and general technical assistance. Throughout this process, MTC should stress that this is not a one-time exercise and that agencies will need to develop and maintain their own, internal processes for collecting, maintaining and reporting this data. As mentioned above, the majority of the effort on the part of the operator is expected up-front. If done right the first time, updates will be much easier.

   MTC should develop some data validation processes to evaluate the quality, reliability, and consistency of the data being supplied by the local operators. To be most effective, these should proceed in concert with the tasks above. This will ensure that any agency reporting issues are identified and corrected during the development phase (i.e., before poor data reporting practices can become established).

8.0 APPENDICES

8.1 Appendix A – Individual Operator Surveys

This section contains the individual operator answers to Questions A-G outlined above in Exhibit 2-2. Operators are listed alphabetically by Tier, using their acronym.

8.2 Appendix B – Blank Interview Guides

Appendix B contains the blank Tier 1 and Tier 2 interview guides.

8.3 Appendix C – Inventory Level of Detail Asset Lists

Appendix C contains a listing of the most common asset permutations within the Booz Allen proposed Inventory Architecture, for the recommended level of detail (Level of Detail 2 for most major asset classes, Level of Detail 3 for vehicles).

8.4 Appendix D – The Matrix: Assessment of Operator Ability to Report on Proposed Inventory Architecture

Appendix D contains the consultant team's assessment of transit agency ability to report on the three levels of detail in the RTCI architecture, for all major asset classes.

8.5 Appendix E – Operator Comments to Draft Report

Appendix E contains comments the consultant team received from the operators, concerning the Draft Final Report submitted to MTC March 23, 2007, along with comments fielded during working group sessions, as well as a short resolution.

Base Contact Information

Agency: _____
Contact Name: _____
Contact Position: _____
Department: _____
Address: _____
Contact Phone: _____
Contact e-mail: _____

Interviewee Target List (Name, Phone Number)

Chief Financial Officer _____
Chief Mechanical Officer _____
Chief Operating Officer _____
Senior Capital Planner _____
Senior Grants Manager _____
Title 1 _____
Title 2 _____

I. CAPITAL ASSET DATA

The questions below are intended to determine what transit capital asset data is collected stored and used by your agency, e.g., level of detail used in managing and reporting, how rehabilitation and replacement costs are estimated and accounted, how capital assets are replaced within the database. In addition, we are requesting information on how this data is used within the agency, shared among various operating divisions and then reported to funding agencies such as MTC and FTA.

GENERAL

1. What types of data on capital assets do you maintain, including but not limited to types of assets, data fields (e.g., asset type, date built / acquired, location, current condition, purchase cost) for each asset type and level of detail? Why is the information kept at this level? Do you have any plans to streamline or augment data collection in the future?

2. Who collects your asset inventory data? Do different internal divisions collect data for different asset types (e.g., vehicles, structures, trackwork, systems, facilities)?

3. What are the data used for (e.g., replacement needs analysis, asset depreciation accounting, grants management, maintenance management)? Does the use of this data differ by asset type?

4. How and how often do you update your capital asset data? How often do you enter records for newly acquired assets? Are records for retired assets removed from the inventory or otherwise marked as retired?

5. How current, complete and accurate is your capital asset data? What, typically, are the main reasons why data may have gaps, inaccuracies, or outdated information? Is there one type of asset for which it has been particularly challenging to maintain complete and accurate data?

6. How does each operator store and utilize capital asset data, and how is the capital asset information communicated between the operator's internal divisions?

REHABILITATION

7. How do you use your capital asset data to manage your rehabilitation and replacement needs, and to estimate costs for such projects? For what types of assets do you record asset maintenance and rehabilitation services?

8. What data on rehabilitation and replacement costs is maintained? How are costs determined? How are these cost data used?

FUNDING REQUESTS

9. Is this information used for funding requests, or are other systems used?

How closely do asset management staff coordinate with funding / grants staff?

10. How are capital data used to respond to MTC requests for information on capital data needs for development of the regional long term transportation plan (Transportation 2030)? How do you prepare data for input into ***Finance Plan***?

How are the capital data used to respond to MTC calls for projects to initiate the programming of Transit Capital Priorities funds?

11. Rail Operators Only – How are projects created that are submitted for MTC's Transit Capital Priorities process in the Infrastructure Programs? Are they based on currently identified deficiencies? Are they based on lifecycle replacement needs? How are these calculated? If they are based on current deficiencies, how are these identified (maintenance forces, consultant inspections / assessments) ?

12. What other issues do you see pertaining to your transit capital data and data management systems?

CAPITAL ASSET MANAGEMENT SYSTEMS

These questions are focused on the systems in place to manage your capital asset: database system used, the responsibility for maintaining this information, the data fields, the frequency of reporting, the updating process and the internal sharing of the database information within your organization.

13. What data management system(s), if any, do the operators use to track and manage their capital assets and repair, rehabilitation and replacement needs?

14. What types of data on capital assets are maintained in which system, including but not limited to types of assets, data fields for each asset type and level of detail?

15. How and how often do you update your capital asset database in the system?

16. Is the data within the system confirmed for accuracy with the engineering, procurement, maintenance and operating staff?

17. What data standards and formatting should the region establish for the RTCI in order to improve MTC's ability to forecast the need for transit capital rehabilitation and replacement funding in the region, and to program available funding to meet the highest priority needs?

18. Would you recommend a data standard, data management system(s), and/or internal processes that are most important aspects to the reporting of transit capital inventory?

19. What additional steps are required for your agency to report transit capital inventory data to the MTC such as additional data gathering, software, and/or staff resources?

20. What additional costs, both initial and ongoing, would you incur to develop, maintain and report transit capital inventory data to the MTC?

21. What recommendations would you make to the use of capital asset data to manage rehabilitation and replacement needs, to estimate costs for such projects, and to meet MTC reporting requirements?

22. What other issues pertaining to transit capital data and data management systems would you raise that are relevant to the RTCI project .

Base Contact Information

Agency: _____
Contact Name: _____
Contact Position: _____
Department: _____
Address: _____
Contact Phone: _____
Contact e-mail: _____

Interviewee Target List (Name, Phone Number)

Chief Financial Officer _____
Chief Mechanical Officer _____
Chief Operating Officer _____
Senior Capital Planner _____
Senior Grants Manager _____
Title 1 _____
Title 2 _____

I. CAPITAL ASSET MANAGEMENT SYSTEMS

These questions are focused on the systems in place to manage your capital asset: database system used, the responsibility for maintaining this information, the data fields, the frequency of reporting, the updating process and the internal sharing of the database information within your organization.

1. What data management system(s), if any, do you use to track and manage your capital assets and repair, rehabilitation and replacement needs?

2. What types of data on capital assets are maintained in which system, including but not limited to types of assets, data fields for each asset type and level of detail?

3. How and how often do you update your capital asset database in the system?

4. Is the data within the system confirmed for accuracy with the engineering, procurement, maintenance and operating staff?

II. CAPITAL ASSET DATA

The questions below are intended to determine what transit capital asset data is collected stored and used by your agency, e.g., level of detail used in managing and reporting, how rehabilitation and replacement costs are estimated and accounted, how capital assets are replaced within the database. In addition, we are requesting information on how this data is used within the agency, shared among various operating divisions and then reported to funding agencies such as MTC and FTA.

GENERAL

5. What types of data on capital assets do you maintain, including but not limited to types of assets, data fields (e.g., asset type, date built/acquired, location, current condition, purchase cost) for each asset type and level of detail? Why is the information kept at this level? Do you have any plans to streamline or augment data collection in the future?

6. Who collects your asset inventory data? Do different internal divisions collect data for different asset types (e.g., vehicles, structures, trackwork, systems, facilities)?

7. What are the data used for (e.g., replacement needs analysis, asset depreciation accounting, grants management, maintenance management)? Does the use of this data differ by asset type?

8. How and how often do you update your capital asset data? How often do you enter records for newly acquired assets? Are records for retired assets removed from the inventory or otherwise marked as retired?

9. How current, complete and accurate is your capital asset data? What, typically, are the main reasons why data may have gaps, inaccuracies, or outdated information? Is there one type of asset for which it has been particularly challenging to maintain complete and accurate data?

10. How does each operator store and utilize capital asset data, and how is the capital asset information communicated between the operator's internal divisions?

REHABILITATION

11. How do you use your capital asset data to manage your rehabilitation and replacement needs, and to estimate costs for such projects? For what types of assets do you record asset maintenance and rehabilitation services?

12. What data on rehabilitation and replacement costs is maintained? How are costs determined? How are these cost data used?

FUNDING REQUESTS

13. Is this information used for funding requests, or are other systems used?

How closely do asset management staff coordinate with funding / grants staff?

14. How are capital data used to respond to MTC requests for information on capital data needs for development of the regional long term transportation plan (Transportation 2030)? How do you prepare data for input into ***Finance Plan***?

How are the capital data used to respond to MTC calls for projects to initiate the programming of Transit Capital Priorities funds?

15. From your perspective, what is your recommendation, if any, for an improved reporting process for transit capital inventory to MTC? Consider the easiest way for your agency to report e.g. Excel, database, etc. What are the most important aspects of your recommendation and why?

16. What other issues pertaining to transit capital data and data management systems would you raise that are relevant to the RTCI project?

Asset Class Elements				Operators to Populate these Columns							
Category	Element 1	Element 2	Element 3	Unit (Mile)	Date Built (Year)	Useful Life (Years)	Purchase /Replacement Cost	Number of Capital Rehabs per Life Cycle	Rehab Life Cycle (Years between Rehabs)	Rehabilitation Cost per Rehab	Annual Capital Maintenance Cost
Guideway	Roadway	At grade	Exclusive								
Guideway	Roadway	At grade	Mixed traffic								
Guideway	Roadway	At grade	Semi exclusive								
Guideway	Railway	Above	Elevated fill								
Guideway	Railway	Above	Elevated structure								
Guideway	Railway	At grade	Grade Crossing								
Guideway	Railway	Below	Cut and cover								
Guideway	Railway	Below	Retained cut								
Guideway	Railway	Below	Tunnel								
Guideway	Channel	Ferry/Dredging	Depth								

Asset Class Elements				Operators to Populate these Columns							
Category	Element 1	Element 2	Element 3	Unit (Mile)	Next Replacement Year (Year)	Useful Life (Years)	Purchase/ Replacement Cost	Number of Capital Rehabs per Life Cycle	Rehab Life Cycle (Years between Rehabs)	Rehabilitation Cost per Rehab	Annual Capital Maintenance Cost
Railway/Track	Light Rail	Ballast	Tangent								
Railway/Track	Light Rail	Ballast	Curve								
Railway/Track	Light Rail	Ballast	Station								
Railway/Track	Light Rail	Ballast	Yard								
Railway/Track	Light Rail	Embedded	Tangent								
Railway/Track	Light Rail	Embedded	Curve								
Railway/Track	Light Rail	Embedded	Station								
Railway/Track	Light Rail	Embedded	Yard								
Railway/Track	Light Rail	In Street	Tangent								
Railway/Track	Light Rail	In Street	Curve								
Railway/Track	Light Rail	In Street	Station								
Railway/Track	Light Rail	Special	-								
Railway/Track	Heavy Rail	Ballast	Tangent								
Railway/Track	Heavy Rail	Ballast	Curve								
Railway/Track	Heavy Rail	Ballast	Station								
Railway/Track	Heavy Rail	Ballast	Yard								
Railway/Track	Heavy Rail	Embedded	Tangent								
Railway/Track	Heavy Rail	Embedded	Curve								
Railway/Track	Heavy Rail	Embedded	Station								
Railway/Track	Heavy Rail	Embedded	Yard								
Railway/Track	Heavy Rail	Special	-								
Railway/Track	Commuter Rail	Ballast	Tangent								
Railway/Track	Commuter Rail	Ballast	Curve								
Railway/Track	Commuter Rail	Ballast	Station								
Railway/Track	Commuter Rail	Ballast	Yard								
Railway/Track	Commuter Rail	Embedded	Tangent								
Railway/Track	Commuter Rail	Embedded	Curve								
Railway/Track	Commuter Rail	Embedded	Station								
Railway/Track	Commuter Rail	Embedded	Yard								
Railway/Track	Commuter Rail	Special	-								

Asset Class Elements			Operators to Populate these Columns							
Category	Element 1	Element 2	Unit (Mile)	Date Built (Year)	Useful Life (Years)	Purchase/Replacement Cost	Number of Capital Rehabs per Life Cycle	Rehab Life Cycle (Years between Rehabs)	Rehabilitation Cost per Rehab	Annual Capital Maintenance Cost
Roadway	Local	Concrete								
Roadway	Local	Asphalt								
Roadway	Arterial	Concrete								
Roadway	Arterial	Asphalt								
Roadway	Highway	Concrete								
Roadway	Highway	Asphalt								
Roadway	Facility	Concrete								
Roadway	Facility	Asphalt								

Asset Class Elements					Operators to Populate these Columns							
Category	Element 1	Element 2	Element 3	Element 4	Unit (Number, Square Feet)	Date Built (Year)	Useful Life (Years)	Purchase/ Replacement Cost	Number of Capital Rehabs per Life Cycle	Rehab Life Cycle (Years between Rehabs)	Rehabilitation Cost per Rehab	Annual Capital Maintenance Cost
Stations	At grade	Structure	Brick	-								
Stations	At grade	Structure	Concrete	-								
Stations	At grade	Structure	Steel	-								
Stations	At grade	Roof	-	-								
Stations	At grade	Canopy	-	-								
Stations	At grade	Platform	Side	-								
Stations	At grade	Platform	Center	-								
Stations	Subway	Structure	-	-								
Stations	Subway	Platform	Side	-								
Stations	Subway	Platform	Center	-								
Stations	Elevated	Structure	Brick	-								
Stations	Elevated	Structure	Concrete	-								
Stations	Elevated	Structure	Steel	-								
Stations	Elevated	Roof	-	-								
Stations	Elevated	Canopy	-	-								
Stations	Elevated	Platform	Side	-								
Stations	Elevated	Platform	Center	-								
Stations	Elevator	-	-	-								
Stations	Escalator	-	-	-								
Stations	Public address systems	-	-	-								
Stations	Destination signs	-	-	-								
Stations	Alarm systems	-	-	-								
Stations	Emergency backup system	-	-	-								
Stations	Access Facilities	Auto Park Garage	-	-								
Stations	Access Facilities	Auto Park Lot	-	-								
Stations	Access Facilities	Kiss & Ride	-	-								
Stations	Access Facilities	Bus Transfer Area	-	-								
Stations	Access Facilities	Bike	-	-								
Stations	Access Facilities	Ped. Overpass	-	-								
Stations	Ferry - Dock	-	-	-								
Stations	Ferry - Float	-	-	-								
Stations	Ferry - Moveable Gantry Ramp	-	-	-								
Stations	Electrical System	-	-	-								
Stations	Equipment	-	-	-								
Stations	HVAC	-	-	-								
Stations	Landscape	-	-	-								
Stations	Mezzanine	-	-	-								
Stations	Plumbing	-	-	-								
Stations	Public toilets	-	-	-								
Stations	Station attendant booth	-	-	-								

Asset Class Elements					Operators to Populate these Columns							
Category	Element 1	Element 2	Element 3	Element 4	Unit (Number)	Date Built (Year)	Useful Life (Years)	Purchase/ Replacement Cost	Number of Capital Rehabs per Life Cycle	Rehab Life Cycle (Years between Rehabs)	Rehabilitation Cost per Rehab	Annual Capital Maintenance Cost
Facilities	Maintenance	Light Maint. Activities	Alarm systems	-								
Facilities	Maintenance	Light Maint. Activities	Backup power	-								
Facilities	Maintenance	Light Maint. Activities	Electrical System	-								
Facilities	Maintenance	Light Maint. Activities	HVAC	-								
Facilities	Maintenance	Light Maint. Activities	Parking/Circulator/Access	-								
Facilities	Maintenance	Light Maint. Activities	Plumbing	-								
Facilities	Maintenance	Light Maint. Activities	Roof	-								
Facilities	Maintenance	Light Maint. Activities	Service Line	Fuel								
Facilities	Maintenance	Light Maint. Activities	Service Line	Clean								
Facilities	Maintenance	Light Maint. Activities	Service Line	Revenue								
Facilities	Maintenance	Light Maint. Activities	Structure	Brick								
Facilities	Maintenance	Light Maint. Activities	Structure	Concrete								
Facilities	Maintenance	Light Maint. Activities	Structure	Steel								
Facilities	Maintenance	Light Maint. Activities	Train washers	-								
Facilities	Maintenance	Heavy Maint. Activities	Alarm systems	-								
Facilities	Maintenance	Heavy Maint. Activities	Backup power	-								
Facilities	Maintenance	Heavy Maint. Activities	Cranes	-								
Facilities	Maintenance	Heavy Maint. Activities	Electrical System	-								
Facilities	Maintenance	Heavy Maint. Activities	HVAC	-								
Facilities	Maintenance	Heavy Maint. Activities	Parking/Circulator/Access	-								
Facilities	Maintenance	Heavy Maint. Activities	Plumbing	-								
Facilities	Maintenance	Heavy Maint. Activities	Roof	-								
Facilities	Maintenance	Heavy Maint. Activities	Service Line	Clean								
Facilities	Maintenance	Heavy Maint. Activities	Service Line	Revenue								
Facilities	Maintenance	Heavy Maint. Activities	Structure	Brick								
Facilities	Maintenance	Heavy Maint. Activities	Structure	Concrete								
Facilities	Maintenance	Heavy Maint. Activities	Structure	Steel								
Facilities	Maintenance	Heavy Maint. Activities	Turntables	-								
Facilities	Maintenance	Heavy Maint. Activities	Wheel presses	-								
Facilities	Maintenance	Heavy Maint. Activities	Wheel truing machines	-								
Facilities	Maintenance	Equipment	Buswasher	-								
Facilities	Maintenance	Equipment	Dynamoneter	-								
Facilities	Maintenance	Equipment	Lifts	-								
Facilities	Administrative	Alarm systems	-	-								
Facilities	Administrative	Backup power	-	-								
Facilities	Administrative	Electrical System	-	-								
Facilities	Administrative	HVAC	-	-								
Facilities	Administrative	Parking/Circulator/Access	-	-								
Facilities	Administrative	Plumbing	-	-								
Facilities	Administrative	Roof	-	-								
Facilities	Administrative	Structure	Brick	-								
Facilities	Administrative	Structure	Concrete	-								
Facilities	Administrative	Structure	Steel	-								

Asset Class Elements				Operators to Populate these Columns							
Category	Element 1	Element 2	Element 3	Unit (Miles, Number)	Date Built (Year)	Useful Life (Years)	Purchase /Replacement Cost	Number of Capital Rehabs per Life Cycle	Rehab Life Cycle (Years between Rehabs)	Rehabilitation Cost per Rehab	Annual Capital Maintenance Cost
Systems	Train control	Fixed/wayside	-								
Systems	Train control	Moving block	-								
Systems	Train control	Communications based	-								
Systems	Train control	Centralized control	-								
Systems	Train control	Gates/crossing protection	-								
Systems	Train control	Relay rooms	-								
Systems	Train control	Conduit/Cable	-								
Systems	Bus control	Traffic signals	-								
Systems	Bus control	Centralized control	-								
Systems	Traction power	Substations	Structure								
Systems	Traction power	Substations	Major Elements								
Systems	Traction power	Breaker houses	-								
Systems	Traction power	Catenary	-								
Systems	Traction power	Third rail	-								
Systems	Traction power	Conduit/Cable	-								
Systems	Traction power	Transformers									
Systems	Communications	Voice-radio	Mobile Radio								
Systems	Communications	Voice-radio	Bus Radio								
Systems	Communications	Voice-radio	Base station								
Systems	Communications	Voice-radio	Transmitters								
Systems	Communications	Voice-radio	PBX								
Systems	Communications	Voice-radio	Public announcement								
Systems	Communications	Communications network	-								
Systems	ITS	GPS	-								
Systems	ITS	AVL	-								
Systems	ITS	CAD	-								
Systems	ITS	APC	-								
Systems	Fare collection	Stations	TVM/add fare								
Systems	Fare collection	Stations	Turnstiles/faregates								
Systems	Fare collection	Vehicles	Fareboxes								
Systems	Fare collection	Central revenue counting	Coin Counters								
Systems	Fare collection	Central revenue counting	Bill Counters								
Systems	Fare collection	Central revenue counting	Ticket Encoders								
Systems	Fare collection	Central revenue counting	Translink								
Systems	Utilities	Lighting	-								
Systems	Utilities	Pump stations	-								
Systems	Utilities	Subway Pump System	-								
Systems	Utilities	Ventilation	Fans								
Systems	Utilities	Ventilation	Dampers								
Systems	Utilities	Ventilation	Control Systems								

Asset Class Elements					Operators to Populate these Columns									
Category	Element 1	Element 2	Element 3	Element 4	Length (Feet)	Seated Capacity (Passengers)	Unit (Number)	Date Built (Year)	Useful Life (Years)	Purchase /Replacement Cost	Number of Capital Rehabs per Life Cycle	Rehab Life Cycle (Years between Rehabs)	Rehabilitation Cost per Rehab	Annual Capital Maintenance Cost
Vehicles	Revenue	Bus - Articulated	Heavy-Duty, 12-year	Electric - Catenary										
Vehicles	Revenue	Bus - Articulated	Heavy-Duty, 12-year	Diesel										
Vehicles	Revenue	Bus - Articulated	Heavy-Duty, 12-year	CNG										
Vehicles	Revenue	Bus - Articulated	Heavy-Duty, 12-year	LP										
Vehicles	Revenue	Bus - Articulated	Heavy-Duty, 12-year	Hybrid										
Vehicles	Revenue	Bus	Heavy-Duty, 12-year	Electric - Catenary										
Vehicles	Revenue	Bus	Heavy-Duty, 12-year	Diesel										
Vehicles	Revenue	Bus	Heavy-Duty, 12-year	CNG										
Vehicles	Revenue	Bus	Heavy-Duty, 12-year	LP										
Vehicles	Revenue	Bus	Heavy-Duty, 12-year	Hybrid										
Vehicles	Revenue	Bus	Heavy-Duty, 10-year	Diesel										
Vehicles	Revenue	Bus	Heavy-Duty, 10-year	CNG										
Vehicles	Revenue	Bus	Heavy-Duty, 10-year	LP										
Vehicles	Revenue	Bus	Heavy-Duty, 10-year	Hybrid										
Vehicles	Revenue	Bus	Medium-Duty, 7-year	Diesel										
Vehicles	Revenue	Bus	Medium-Duty, 7-year	Gasoline										
Vehicles	Revenue	Bus	Medium-Duty, 7-year	CNG										
Vehicles	Revenue	Bus	Medium-Duty, 7-year	Hybrid										
Vehicles	Revenue	Cutaway	Light-Duty, 5-year	Diesel										
Vehicles	Revenue	Cutaway	Light-Duty, 5-year	Gasoline										
Vehicles	Revenue	Cutaway	Light-Duty, 5-year	CNG										
Vehicles	Revenue	Cutaway	Light-Duty, 5-year	Hybrid										
Vehicles	Revenue	Cutaway	Light-Duty, 4-year	Diesel										
Vehicles	Revenue	Cutaway	Light-Duty, 4-year	Gasoline										
Vehicles	Revenue	Cutaway	Light-Duty, 4-year	CNG										
Vehicles	Revenue	Van	Light-Duty, 4-year	Diesel										
Vehicles	Revenue	Van	Light-Duty, 4-year	Gasoline										
Vehicles	Revenue	Van	Light-Duty, 4-year	CNG										
Vehicles	Revenue	Auto	Light-Duty, 4-year	Diesel										
Vehicles	Revenue	Auto	Light-Duty, 4-year	Gasoline										
Vehicles	Revenue	Auto	Light-Duty, 4-year	CNG										
Vehicles	Revenue	Auto	Light-Duty, 4-year	Hybrid										
Vehicles	Revenue	Light Rail	-	-										
Vehicles	Revenue	Heavy Rail	-	-										
Vehicles	Revenue	Commuter Rail - Single Level	-	-										
Vehicles	Revenue	Commuter Rail - Bi Level	-	-										
Vehicles	Revenue	Commuter Rail - Power Car	-	-										
Vehicles	Revenue	Commuter Rail - Multiple Unit	-	-										
Vehicles	Revenue	Locomotive	-	-										
Vehicles	Revenue	Cable Car	-	-										
Vehicles	Revenue	Ferry	-	-										
Vehicles	Non Revenue	Auto	-	-										
Vehicles	Non Revenue	Van	-	-										
Vehicles	Non Revenue	Truck	Light	Pickup										
Vehicles	Non Revenue	Truck	Light	Other										
Vehicles	Non Revenue	Truck	Heavy	-										
Vehicles	Non Revenue	Special Vehicle	Geometry Car	-										
Vehicles	Non Revenue	Special Vehicle	Rail Grinder	-										
Vehicles	Non Revenue	Special Vehicle	Other	-										